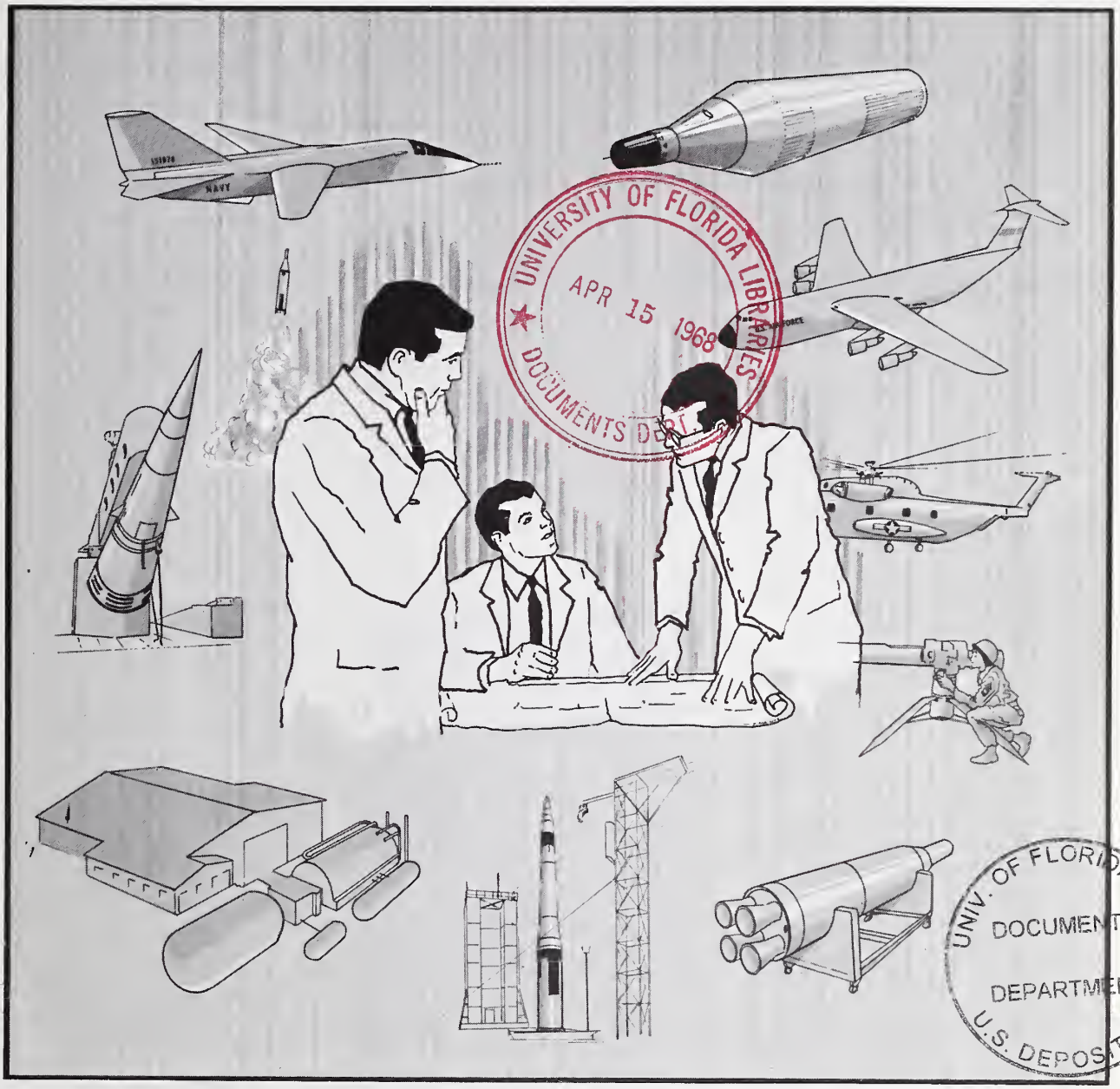
DEFENSE INDUSTRY BULLETIN

Vol. 4 No. 4 April 1968



DEFENSE RESEARCH, DEVELOPMENT, TEST AND EVALUATION PROGRAM

(Excerpts from statement by Dr. John S. Foster Jr., Director of Defense Research and Engineering, on the FY 1969 Defense, Research, Development, Test and Evaluation Program before the Senate Committee on Armed Services begins on page 27.)

IN THIS ISSUE

FEATURES

Programs and Services of the Defense Documentation Center
Robert H. Rea ---- 1

The Audit Role in Value Engineering
Frank Romeo
Herbert B. Goodwin ---- 6

Standardization of Components/Equipments in the Naval Material Command
Harry Dickinson ---- 14

The Government's Role in Minding Its Contractor's Business
Brigadier General Daniel E. Riley, USAF ---- 20

The Door is Open
Major General John B. Bestic, USAF ---- 42

DEPARTMENTS

About People ---- 19

Bibliography ---- 23

Meetings and Symposia ---- 26

From the Speakers Rostrum ---- 27

Defense Procurement ---- 46

The *Defense Industry Bulletin* is published monthly by the Business & Labor Division, Directorate for Community Relations, Office of the Assistant Secretary of Defense (Public Affairs). Use of funds for printing this publication was approved by the Director of the Bureau of the Budget.

The purpose of the *Bulletin* is to serve as a means of communication between the Department of Defense (DOD) and its authorized agencies and defense contractors and other business interests. It will serve as a guide to industry concerning official policies, programs and projects, and will seek to stimulate thought by members of the defense-industry team in solving the problems that may arise in fulfilling the requirements of the DOD.

Material in the *Bulletin* is selected to supply pertinent unclassified data of interest to the business community. Suggestions from industry representatives for topics to be covered in future issues should be forwarded to the Editor. Telephone queries: (202) OXford 5-2709.

The *Bulletin* is distributed without charge each month to representatives of industry and agencies of the Department of Defense, Army, Navy and Air Force. Subscription requests should be made in writing on letterhead and addressed to the Business & Labor Division, OASD(PA), Room 1E764, The Pentagon, Washington, D.C. 20301.

DEFENSE INDUSTRY BULLETIN

Published by the Department of Defense

Hon. Clark M. Clifford
Secretary of Defense

Hon. Paul H. Nitze
Deputy Secretary of Defense

Hon. Phil G. Goulding
Assistant Secretary of Defense (Public Affairs)

Col. George F. Hamel, USA
Director for Community Relations

Capt. John A. Davenport, USN
Chief, Business & Labor Division

LCdr. E. W. Bradford, USN
Editor

Mrs. Cecilia Pollok McCormick
Associate Editor

Capt. Frank W. Kafer, USAF
Associate Editor

Mr. Rick La Falce
Associate Editor

Mr. John E. Fagan
Art Director

Norman E. Worra, JO1, USN
Editorial Assistant

Programs and Services of the Defense Documentation Center

Robert H. Rea

The outpouring of scientific and technical reports, generated by defense expenditures for research and development, is enormous. The reports contain the intangible yet principal product of the research and development efforts—knowledge. As part of a continuing cycle, the knowledge or information contained in these technical reports can be used by others in current research and development problems and projects.

Approximately $7 billion will be allocated to defense research, development, test and evaluation (RDT&E) projects during the current fiscal year. The projects, and the reports generated through these expenditures, will cover virtually every area of science and technology. An engineer or scientist can be hopeful, then, that in some of these reports are the findings, formulas, procedure descriptions, or other information that he needs to accelerate his own efforts. Occasionally the needed information is contained in reports produced one or two decades ago. Just where are these reports now, and what aids are there to retrieve those which have most of the data he needs? And—very important—how can he get copies of these reports quickly?

If that scientist or engineer is associated with an organization within the Federal research and development community—Federal agencies, their contractors, subcontractors and grantees, a principal source of pertinent scientific and technical reports would be the Defense Documentation Center (DDC).

DDC, a major field activity of the Defense Supply Agency, is the central facility within DOD for secondary distribution of RDT&E documents. The center acquires, processes, stores, announces and provides copies of technical reports to organizations within the Federal research and development community. DDC services are provided without charge to organizations eligible and registered for service.

The center's technical report service is based on the concept that a technical report increases in value each time the information it contains is put to further use. During 1967, DDC received requests for about two million copies of these reports for application to current programs.

Some 2,700 contractor organizations, including many of our nation's largest and smallest research and development organizations, have been exploiting the technical report program and related services offered by DDC. An equal number of military activities and about 550 other Federal users also are tapping this reservoir of technical information.

Robert H. Rea has served with the Defense Documentation Center since 1961 and is presently assigned as a liaison officer in the Office of Customer Relations. In previous assignments, he served as the editor of the *Technical Abstract Bulletin* and as a subject analyst. Mr. Rea holds a bachelors degree from Pennsylvania State University and a masters degree from American University.

To assist organizations in registering for DDC services, the center provides a pamphlet entitled "Registration for Department of Defense Scientific and Technical Information Services." The pamphlet outlines registration procedures and is complete with copies of the DOD forms required.

The principal form used in registering for service is the DD Form 1540, titled "Registration for Scientific and Technical Information Services." It is the only form required of military organizations for service.

The completion and submission of the DD Form 1540 by contractors, subcontractors and grantees varies according to whether the request includes classified document service. Directions for these procedures are specific within the pamphlet.

If classified service is requested by any organization other than military, the use of DD Form 1541, titled "Facility Clearance Register," is also required. Two copies of this form are forwarded to the cognizant Defense Contract Administration Services Region (DCASR) for certification. In essence, the Form 1541, when approved and forwarded by the DCASR to DDC, verifies that the facilities of the requesting organization have been inspected and have been found proper to protect the classified documents which would be provided to that organization.

Potential defense contractors may also use the services of the center through individual programs established by the Military Departments; an example is the Air Force Technical Objectives Document (TOD) program.

Readers associated with organizations not eligible for DDC services

may be interested in the services offered by the Department of Commerce through the Clearinghouse for Scientific and Technical Information, 5285 Port Royal Road, Springfield, Virginia 22151. The clearinghouse makes unclassified reports of the Defense Department and other Federal agencies available to the public at nominal cost.

DDC's technical report collection exceeds 850,000 titles. Documents collected by the center's predecessor organizations (The Armed Services Technical Information Agency, Central Air Documents Office, and the Navy Research Section of the Library of Congress) stem from the years during and following World War II, and include documents captured from the Germans and Japanese during the later phases of that war. Although hard copies of documents from the early collections have been retired, reproductions can still be made available by DDC from copies stored through microphotography.

Information on about half a million of the reports is stored in the center's computers. In the wide subject area of physics, there are more than 70,000 reports under computer control for quick retrieval. Nearly 50,000 of the reports are in the electronics and electrical engineering area, and about 40,000 concern studies in navigation, communications and detection equipments. These are only three of a wide range of subject areas used to index reports at DDC. Within many of these documents are the answers, or at least time-saving guides, concerning problems being worked on today throughout the Federal research and development community.

Documents in the collection range from unclassified to Secret and Restricted Data reports. They reflect billions of dollars expended over the years for defense-related research and development programs. For example, there are reports in the collection which were generated through the $10 billion invested in developing strategic missiles over the last decade. Reports of this type range from the concept formulation studies through full development.

Currently, some 50,000 technical documents are being added to the collection each year. The reports are furnished by military activities, either directly or through industrial, educational, or non-profit agencies working under contract agreements or grants.

DOD directives require that defense activities, their contractors, subcontractors and grantees provide DDC with 20 copies each of the technical reports which formally record the results of defense efforts in research and development. The 20 copies are sufficient to respond to the average number of requests per technical report. These documents are screened on arrival at the center to make certain they contain information of scientific and technical value, that they are not duplicates of documents already in the collection, and that any limitations on distribution are worded in accordance with DOD Directive 5200.20.

A control (Accession Document or AD) number is stamped on each copy of a particular title. Of the 20 copies received, one is used for processing and is photographed for microfiche storage; the other 19 are used for response to user's requests for copies of the report. If additional copies are needed, they are reproduced from microfiche at the center.

For announcement purposes, technical reports accessioned by DDC are categorized in a two-level arrangement consisting of 22 major subject fields, with a further subdivision of the fields into 188 subject groups. Except for an extension of 10 additional subject groups, this is the standard which was developed through the Committee on Scientific and Technical Information (COSATI) of the Federal Council on Science and Technology. The standard is titled the "COSATI Subject Category List" (AD-612 000). The version used by DDC is "COASATI Subject Category List (DOD Extended)" (AD–624 000).

The 22 broad subject fields are

- Aeronautics.
- Agriculture.
- Astronomy and Astrophysics.
- Atmospheric Sciences.
- Behavioral and Social Sciences.
- Biological and Medical Sciences.
- Chemistry.
- Earth Sciences and Oceanography.
- Electronics and Electrical Engineering.
- Energy Conversion (Non-propulsive).

Nearly two million copies of technical reports were mailed in 1967 to the 6,000 Federal and civilian organizations registered for DDC services.

- Materials.
- Mathematical Sciences.
- Mechanical, Industrial, Civil and Marine Engineering.
- Methods and Equipment.
- Military Sciences.
- Missile Technology.
- Navigation, Communications, Detection and Countermeasures.
- Nuclear Science and Technology.
- Ordnance.
- Physics.
- Propulsion and Fuels.
- Space Technology.

DDC announces the existence and availability of documents accessioned through its own announcement publication and through announcement media of the Department of Commerce.

Classified reports and unclassified reports, having limitations on distribution, are announced in the Confidential *DDC Technical Abstract Bulletin* (TAB). Announcements of unclassified reports, having no distribution limitations, are announced with similar reports produced by other Federal agencies in the *U.S. Government Research and Development Reports* (USGRDR), published by the Clearinghouse for Federal Scientific and Technical Information of the Department of Commerce ($22.00 per year). TAB and the unclassified USGRDR are each distributed twice a month.

Companion index volumes are available with each issue of the aforementioned announcement publications to aid the user in determining quickly which, if any, new accessions to the collection are of particular interest. Each of these reference tools includes a Corporate Author-Monitoring Agency Index, Subject Index, Personal Author Index, Contract Number Index, a Report Number (or correlation) Index, and a Release Authority Index. TAB indexes are cumulated quarterly and annually as references to the collection.

Registered user organizations may request copies of the technical reports in either full-size or microform. Technical reports accessioned by DDC since Aug. 1, 1965, are stored on microfiche; documents accessioned earlier are stored on microfilm.

Upon registration, the organization is sent a deck of punch cards (DDC Form 1) which are used for requesting copies of technical reports. The user code number assigned to the organization has been key-punched in the form. To request a document, the scientist or engineer need only record the control number of the report, the contract or grant number under which he is requesting service (if non-government user), the date of the request, and indicate whether he wants a full-size copy of the report or microform copy.

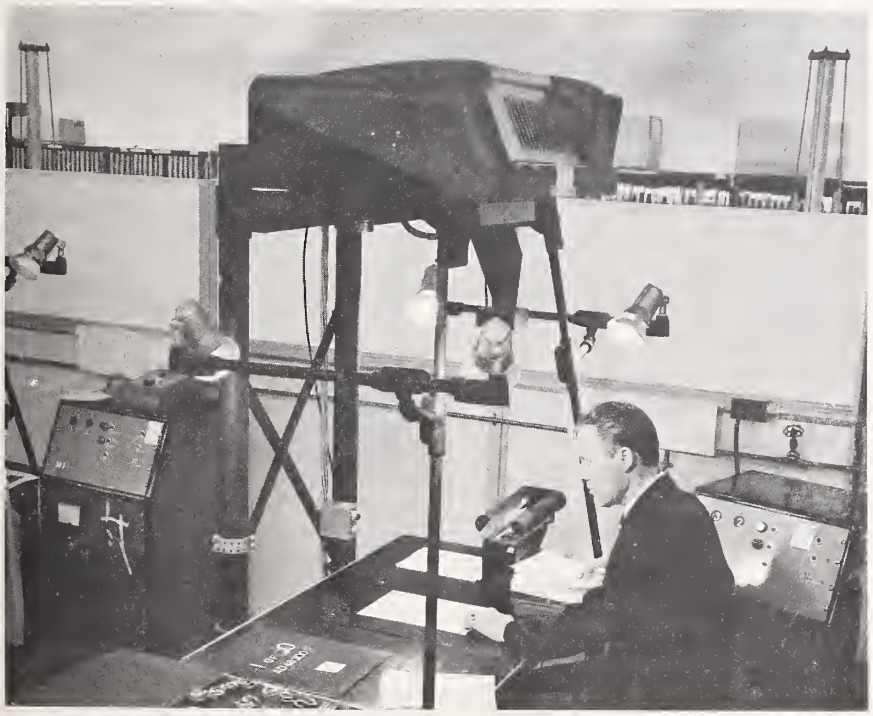
On occasion, a user will learn of a report which he believes should be in the DOD collection, but is unable to determine the information concerning the document. If he provides sufficient descriptive information concerning the report on the reverse side of the Document Request Form, DDC will make a search to determine its AD number and provide a copy of the report, if it can be released to the requester. If the report is not in the collection and sufficient identification has been provided, DDC will take action to acquire the report.

DDC receives about 8,000 requests for reports on the average workday. The requests are computer processed to match the information on the request forms with information concerning user organizations, and with document inventory and release information stored on magnetic tape. When appropriate, the computer determines the validity of the request based on security classification, need-to-know, and distribution limitations.

The average document request processing time within DDC varies from two days, if the report is in stock, to five days, if the report has to be reproduced. Actual portal-to-portal time for the requests depends on the postal service.

Approximately one-fourth of the requests received are for copies of documents in microfiche form. Industry is finding that this "new" microform is easier and less expensive to store, retrieve and reproduce than either full-size copy or microfilm. The latter had been the center's principal medium of microstorage.

DDC's microfiche are produced in accordance with the Federal Mircofiche Standards. The size of the sheet film is approximately four-by-six inches. The center's format permits up to 58 page-microimages to be stored on the first sheet of microfiche and up to 70 microimages on succeeding sheets.



Technical reports accessioned by DDC are permanently stored on microfiche. Copies of the reports are available in full-size or in microform.

Using the microfiche medium, today's engineer can maintain his personal library of thousands of reference documents in just one desk drawer. To use the data, he would need only a microform reader, and many of these are being manufactured in sizes compact enough to be listed and priced as desk accessories.

The announcement publications are effective in disseminating information on documents currently accessioned. But how does a user get information on documents produced a year, a decade, or even a quarter century ago?

As a related function within the technical report program, DDC provides a bibliography service to registered user organizations. Through this service, the center produces listings which describe technical reports in the collection relating to particular subject areas.

Bibliographies at DDC take two forms. The first is a printed bibliography that is prepared for those subject areas for which numerous requests for bibliographies are anticipated. A typical example would be a bibliography on shock and vibration environment. Such bibliographies are added to the DDC collection complete with accession document (control) numbers and announced in TAB. They are requested by user organizations in the same manner as other documents in the collection.

The second type of bibliography, demand bibliography, is prepared in response to a specific request for references to technical reports which cover a particular research problem or project. A user submits a bibliography request (DDC Form 4) on which he gives pertinent information including the organization and its address, the contract or grant number (if appropriate), and user code number, and then, in as specific terms as possible, describes his research problem or project. An important item of information to be included with the request is the name and telephone number of the person who is going to put the information to use. Then, if the description of the need for the bibliography is not specific enough, a bibliographer at DDC will contact that individual and try to arrive at the required specificity.

A computer search strategy is prepared from the information on the bibliography request. The resultant computer printout contains descriptions of documents in the collection which are most pertinent to the user's needs. The more than 21,000 requests for bibliographies received in 1967 were processed, within the center, in an average of two and one-half workdays each.

Research and Technology Work Unit Information System

While DDC is a principal source of technical reports on completed research and development, it is also a central source of management and technical information concerning defense-sponsored research and exploratory development efforts currently in progress. The program, which has a tremendous potential for improving management efficiency of the defense research and development effort, is titled "Research and Technology Work Unit Information System."

Essentially, the purpose of the Research and Technology Work Unit Information System is to provide the means to determine quickly who is doing what research, when, where and how. At the end of 1967, this data bank contained more than 24,000 resumes of current efforts in the budget categories 6.1 (Research) and 6.2 (Exploratory Development), as well as selected program elements in 6.3 (Advanced Development) and 6.5 (Management and Support).

There are as many questions that can be put to this information system as there are combinations of elements included on the Research and Technology Resume. Samples of such queries to this data bank are:

- List all defense contracts or grants supporting research in foreign universities.
- Describe all projects supported by the Air Force on flutter of panels.
- Provide list of all military laboratories performing research on ceramics and graphites.
- Who is doing what work on solid propellant rocket engines and what organizations are supporting them?

Input to this data bank is in the form of "work unit" descriptions. For purposes of these technically oriented descriptions, a work unit is defined as the smallest segment into which a project is divided for control purposes at the local organizational level. DOD instructions require that a resume be submitted to DDC for each work unit performed or sponsored by a defense activity.

Information provided through the resume includes title of the effort, originating and performing activities, contract or grant numbers, key dates, and task approach. After initial processing at DDC, the information is fed into the center's computer to provide various types of technical and management information as needed.

The data bank also includes resumes submitted by the National Aeronautics and Space Administration (NASA), which established the system jointly with the Defense Department. DOD and NASA use essentially the same input information.

The Research and Technology Work Unit Information System is designed to provide rapid response to requests in either standard or customized formats. Users may request information in the form of statistical summaries, tabulations, or complete or partial printouts of selected resumes. The physical arrangement of information is up to the requester, who is asked to provide a rough layout of the format he desires. He can indicate the title, the columnar headings, and stub entries to be used on the report.

If the request produces a voluminous report, the user may ask that a table of contents be included. If he wishes access to the report from more than one aspect, he may also obtain a subject index. Historical data concerning the work units completed or terminated can be included, if needed. If the report is to be prepared on a recurring basis, the user determines how often it will be produced, *e.g.*, quarterly, annually. DDC provides informational materials which describe the options available for requests and provide guidance in making the most effective use of the Research and Technology Work Unit Information System.

The Research and Technology Work Unit Information System is a developmental program, the value of which increases the more it is used.

Information from this data bank can be helpful in:

- Preventing costly duplication of effort already performed, or being performed, by others.
- Keeping scientists, engineers, managers and planners abreast of the current state of the art.
- Providing a means for scientists and engineers to learn the organizations and personnel who are performing similar or related tasks, thus providing for greater coordination of effort.
- Speeding product and process development and improvement.

Access to the Research and Technology Work Unit Information System, currently, is limited to Federal agencies. Plans are being formulated, however, to provide limited access to this data bank to non-government organizations within the Federal research and development community.

Other DDC Functions

DDC also operates an Information Sciences Technology Data Bank for the COSATI Panel on Information Sciences Technology; and maintains reports concerning Contractor Performance Evaluations and Contractor Cost Reductions for use by selected military procurement organizations. As a subset of the Research and Technology Work Unit Information System, the center also operates the Interagency (NASA and DOD) Life Sciences Supporting Space Research and Technology Exchange (ILSE).

The center is responsible for the development of long-range concepts and requirements for new DOD documentation and information systems, services and products. The development program, under the policy guidance of the Director of Defense Research and Engineering, is concerned with customer requirements, the state of the art of technologies concerned with information storage and retrieval, and with cooperative interagency systems development.

DDC's referral service extends the scope of its technical report program to include the acquisition, storage and retrieval of information concerning DOD-sponsored specialized sources of scientific and technical information. When authorized users require information exceeding that contained in technical reports, this service is used to direct them to organizations or to individuals who are known or potential sources of this expertise, or to the National Referral Center for Science and Technology of the Library of Congress.

Other services related to the technical report program include the maintenance and continuous development of the DOD "Thesaurus of Engineering and Scientific Terms," and the primary distribution within the United States of certain foreign technical reports.

DDC offers registered user organizations an extended library reference service on some 850,000 technical documents, and computer facilities to quickly retrieve relevant information required in support of the DOD research and development effort.

The DDC services described in this article can save valuable research time and talent for organizations in volved in Federally sponsored projects. Personnel at the center are ready and eager to lend assistance in these research and development programs. For additional information concerning DDC services, write to the:

Defense Documentation Center
Attn: DDC–L
Cameron Station.
Alexandria, Va. 22314

Growth of DDC Services

Research and Technology Work Unit Information System

Work Unit Input	FY 1966	FY 1967
New Records	18,584	12,805
Changes	11,106	24,422
Requests for Data—Output	924	3,194

Technical Report Program

Document Announcements

Fiscal Year	Announcements
1953	7,568
1954	13,729
1955	26,720
1956	34,399
1957	21,015
1958	18,657
1959	31,076
1960	30,061
1961	26,443
1962	23,897
1963	30,613
1964	44,919
1965	*50,603
1966	47,891
1967	50,140

*Excludes 8,635 documents announced in supplements to TAB 64–5.

Document Requests

Fiscal Year	Requests
1953	138,188
1954	209,801
1955	295,814
1956	383,647
1957	454,000
1958	322,000
1959	395,058
1960	547,993
1961	700,100
1962	827,876
1963	1,026,834
1964	1,171,259
1965	1,486,882
1966	1,506,996
1967	1,846,240

The average RDT&E document in the DDC collection is between 60 and 70 pages.

Bibliography Requests

Fiscal Year	Requests
1959	1,326
1960	1,890
1961	3,735
1962	4,166
1963	5,953
1964	7,603
1965	10,079
1966	17,496
1967	20,433

An average of 128 citations were included in the 20,433 bibliographies prepared for DDC user organizations in FY 1967.

The Audit Role in Value Engineering

Frank Romeo
Herbert B. Goodwin

The audit function serves a key role in the financial administration of the DOD Value Engineering (VE) Program. The services of the auditor are used most commonly in two major areas of value engineering activity. The first area concerns Value Engineering Change Proposals (VECPs), submitted by contractors in support of an amount to be negotiated as their share of savings resulting from a contract change which they have proposed. The second involves the validation of value engineering savings claimed under the Defense Department Cost Reduction Program. This article addresses the audit and financial aspects, and some of the problems which characterize each of these two areas.

The first part of this discussion deals with the initial area described, namely, value engineering changes under those contracts which authorize contractor sharing in the resultant savings.

Two Classes of Changes

These changes are known as Class I value engineering changes, not to be confused with Class II changes. The distinction between these two classes of changes is significant.

Class I changes are those whose implementation require an amendment to the contract. They may involve a revision in a contract specification, purchase description, or statement of work. They may include either the elimination or modification of any requirements found to be in excess of actual needs, in such areas as design, components, packaging requirements, testing procedures, and the like. Class II actions, on the other hand, are those changes whose implementation do not require an amendment to the contract. The contracting officer is the only one authorized to make the final determination as to whether a contract requires amendment as a result of a proposed value engineering change.

Most defense contracts awarded in the past few years contain value engineering clauses as specified by Defense Procurement Circular (DPC) No. 11, Oct. 9, 1964. This basic document provides for two types of value engineering motivations: value engineering program requirement clauses and value engineering incentive clauses. The basic difference between these clauses can be summarized as follows: the program requirement clause requires the contractor to perform value engineering at a certain level of effort which is specified as a line item or part of a line item in the contract; under an incentive clause, it is optional with the contractor as to whether he will expend value engineering effort under the contract.

However, both types of clauses provide for contractor sharing, in most cases, in the following types of savings resulting from value engineering:

- **Instant Savings,** to be realized on the contract under which the concontractor submitted his successful VECP.
- **Future Acquisition Savings,** computed on the basis of future procurement by the Government, during a specified period of time, of the item, component, or system which incorporates the value engineering change.
- **Collateral Savings,** based on the net reduction in anticipated government costs, as a result of the value engineering change. These government costs include operations, maintenance, logistic support, and government furnished property.

The recently issued Armed Services Procurement Regulation (ASPR) Revision No. 23 (ASPR Section I, Part 17) rescinded DPC No. 11. While the primary effect of the rescission was to incorporate the DPC into the ASPR, certain changes were made. These differences between the ASPR and the DPC are significant because they have direct impact on either the allowability of value engineering cost incurrence, or the computation of the amount of savings which the Government and the contractor will share.

ASPR Revision No. 23

The first difference to be discussed concerns the area of cost allowability. The essence of the change is the greater precision in definition of allowable cost which is found in Revision 23. Quotation of pertinent passages from the DPC and Revision 23 will illustrate this point. DPC No. 11 stated:

> **Cost allowability will be determined in accordance with normal application of the principles and procedures provided in Section XV. Accordingly, where a contractor already has a value engineering program, the Government will bear a reasonable and allocable share of the cost of this program, but inordinate value engineering cost increases incurred solely because of inclusion of the clause shall not be allowed. Similarly, where a contractor does not have a value engineering program in existence, proper allocable costs of instituting a reasonable value engineering program are allowable.**

However, Revision No. 23 is more specific. It provides that:

> **Value Engineering shall not be allowed as a direct charge against cost-type contracts containing the Incentive clause, and shall be allowed as a direct charge against cost-type contracts containing the**

program requirement clause only to the extent proper to cover the required Value Engineering Program. In either case, the cost of the value engineering is an allowable indirect charge to the extent that, under Section XV, it is reasonable in the conduct of the contractor's business as a whole and allocable to the particular contract.

As far as fixed-price contracts are concerned, Revision 23 provides that "the normal price negotiation policies and techniques in Section III, Part 8, shall be followed in determining whether or to what extent the cost of value engineering may be included in the contract price."

Another significant change between the DPC and the ASPR revision concerns contractor reimbursement for development costs he incurred in connection with successful value engineering proposals. The DPC was silent on this point. However, Revision 23 provides that those contractor costs incurred in developing the value engineering proposal shall be deducted from the total estimated cost savings if these development costs:

- Are proper direct charges of the contract involved.
- Are not otherwise reimbursable under the contract.

The ASPR revision also provides a basis for the identification of development costs in that it specifies that they are normally those costs which have been incurred by the contractor after he has identified a specific value engineering project.

Under both DPC 11 and Revision 23, implementation costs in most cases must be deducted from gross savings in order to arrive at net savings eligible for sharing. While DPC 11 did not define implementation costs, Revision 23 is more specific. It establishes implementation costs as those cost of incorporating a change which are incurred by a contractor after the value engineering proposal has been accepted by the Government.

It can be appreciated that the differences just discussed can have a rather significant impact on the contractor's picture in the value engineering area.

Key Factors in Financial Administration

At this juncture certain observations are in order. The points involved represent some of the key factors which must be reckoned with in the financial administration of the value engineering program.

The difference between Class I and Class II changes has been mentioned and examples of typical Class I changes were offered. However it is not always easy to determine whether a change should be classified as Class I or Class II. However, difficult as the determination may be, the financial impact for both the Government and the contractor can be considerable under a firm-fixed-price contract. If it is decided that the change is a Class I type, the contractor would have to share the savings with the Government. If however the decision is that the change is Class II in nature, the contractor could then retain the full amount of the savings.

DOD personnel, who are responsible for determining whether or not a VECP should be referred for audit in support of negotiation, are not unduly influenced by the amount of instant savings claimed. It is the experience of the Defense Contract Audit Agency, which is the DOD component responsible for audit of this type of contractor proposal, that while instant savings may be nominal, *i.e.*, substantially under $100,000, future acquisition savings can be, and often are, significant.

The time frame for purposes of determining future acquisition savings ranges up to three years. As can easily be seen, a heavy volume of procurement of the value engineered item during this period could result in considerable savings to be shared. To summarize, along with other pertinent factors, the amount of future acquisition, as well as instant savings, is considered in deciding whether the audit route should be taken.

From an estimating point of view, a VECP is substantially the same as any other proposed change to a contract price or, for that matter, an initial price proposal. Any determination of the savings that will accrue from a value engineering change will be no more valid than the estimating techniques used in computing such savings. Procedures have been established for notification to contracting officers in those cases where contractor estimating practices are not considered adequate.

However, it is a fact of life that corrective action is not accomplished overnight. Where minimum reliance can be placed on a contractor's estimating procedure, attention is invited to ASPR Section 1-1704.2. This ASPR section provides for a reduced sharing arrangement in a fixed-price contract not awarded on the basis of competition and, in an incentive type contract, for a share arrangement in accordance with the cost incentive sharing rate of the contract. Implementing this provision under an incentive contract would preclude a contractor from obtaining any advantage in the event that his estimate of savings were faulty; in effect, did not materialize. The resulting overrun would reduce the contractor's profit to what it was prior to amendment for the value engineering change.

Identification of Effort

So much for observations. At this point, it would be appropriate to consider certain subjects that represent problems from the audit point of view.

There is a strong similarity in the nature of contractor effort devoted to value engineering, product improvement, development and/or design activity. In many cases, the same personnel may be used interchangeably in any or all of these areas. The engineering discipline applicable to each of these activities is similar. The problem, then, is how to identify value engineering effort to the exclusion of similar types of effort; particularly where the contractor is or has been funded for these other types of activity under separate contractual arrangement. In order to properly identify an activity, it must be possible to associate it with a specific work objective.

Perhaps the best statement of a work objective for value engineering can be found in Revision 23 which states: "Value Engineering constitutes a systematic and creative effort, not required by any other provision of the contract, directed toward analyzing each contract item or task to assure that its essential function is provided at the lowest overall

cost." In other words, value engineering is an organized effort, specifically directed toward cost reduction. Savings resulting from this effort are not incidental or happenstance to some other program or effort of the contractor.

Once a work objective has been established, specific project or work order identification should be assigned. This identification then enables a contractor to accumulate, as an entity, the cost of the effort associated with a particular work objective, whether it be value engineering, product improvement, or development. Value engineering costs should be separately accumulated and identified, regardless of whether the contractor subsequently charges them to overhead or direct to a contract.

Unfortunately, many contractors do not adequately identify their work objectives. Value engineering costs are variously charged to engineering overhead, design, testing and like functions, losing their identity in the process. As a result, a certain confusion is encountered in the financial phase of a contractor's value engineering program. This is particularly evident when a value engineering change is submitted under a contract with a maximum share ratio, although developed under another contract with a substantially lower share ratio. Also, cases have been noted where, although a contractor is or has been fully funded by the Government for product improvement effort, the results of this effort are often erroneously submitted as a value engineering change under an unrelated contract.

Admittedly, the distinction between product improvement and value engineering may sometimes be difficult to draw. Approaching this distinction from the negative point of view, however, may be helpful. Value engineering does not result in a change of required function or performance. To illustrate, the cover for an electronic circuit is too expensive because it was designed in a hurry with the result it was made largely by hand. Product improvement would improve the design and seek better material and more efficient processes to build it. Value engineering, by contrast, would define the required function of the cover and then seek alternative ways of providing this function, perhaps even eliminating the cover.

Where contracts provide for product improvement or where there are concurrent contracts providing for product improvement, and it is desirable to further motivate the contractor to a value engineering effort, there should be a clear and definite understanding as to which areas are subject to product improvement, and which to value engineering. Otherwise, there is a real problem potential in identifying effort with the objective to which it applies. This, of course, is significant in terms of the ultimate cost to the Government and the savings in which the contractor shall share.

Before leaving this subject of identification of effort, note should be taken of an area that seems to be particularly susceptible to confusion: design engineering effort of a funded nature is easily confused with effort rewardable under a value engineering incentive or program arrangement. Where both design and value engineering effort are authorized under the same contract, to differentiate between the two types of activity it is common to consider any change effected prior to the government authentication of the original design as effort funded under the contract, and not eligible for a value engineering reward.

Implementation Costs

A problem often develops in determining the type of activity whose cost is proper for inclusion in the broad category of implementation costs. In most cases, the savings eligible for sharing must be reduced by these implementation costs. As indicated previously, implementation costs are those costs of incorporating a change which are incurred by a contractor after the value engineering proposal has been accepted by the Government. Although this definition seems fairly specific, there have been varying interpretations. To the auditor, however, implementation costs include the following types of expense, where applicable:

- The cost of parts, already in inventory, that will be rendered obsolete as a result of the change.
- The cost of disposing of these parts.
- Those expenses which are involved in getting the change into production, such as production engineering design; fabrication, installation and maintenance of new tools and equipment; training of personnel; expenses for the labor to install or rearrange production and/or test equipment; and product design and test engineering work to alter existing product drawings, diagrams and test specifications.
- The cost of preparation and publication of changes to operating, maintenance and supply manuals.

Another area that causes concern is the choice of the base cost to be used in computing the gross savings which will result from the value engineering change. This choice becomes significant in those cases where there is an appreciable difference between the negotiated and the actual cost of the item or process being eliminated.

To illustrate the point, assume that an assembly is being replaced as a result of value engineering. Further, assume that the negotiated value of this assembly, as incorporated in the contract price, was $1,000; that the actual cost of fabricating this assembly was $1,300; and the cost of replacement will be $700.

Frank A. Romeo is the audit project officer for the DOD Cost Reduction Program in the Office of the Assistant Secretary of Defense (Comptroller). Prior to assuming this position in 1963, he served eight years with the U. S. Army Audit Agency. Mr. Romeo is a graduate of New York University and is a certified public accountant.

The contractor computes the savings as $600, the actual cost of $1,300 less the replacement cost of $700. The auditor computes the savings as $300, the negotiated value of $1,000 less the replacement cost of $700. We have here a substantial difference in the amount of the savings, depending upon whether negotiated or actual cost is used as the base.

If the contractor's rationale prevailed, conceivably he could obtain a greater reward for an inefficiency that caused him to substantially exceed his original anticipated cost for the assembly. Conversely, had the contractor been successful in producing the assembly for less than the negotiated value, the auditor's procedure would result in a greater reward than would the contractor's, justifiable perhaps on the basis that the indicated production efficiency entitles the contractor to this greater share in savings.

While there was no problem in coming up with negotiated and actual cost figures in the example just discussed, figures are not always that easy to develop in the real situation; many times resort must be made to estimates of both negotiated and actual cost. However, where there is reason to suspect a significant difference between negotiated and actual costs, the principles just discussed are recommended for utilization by DOD personnel in the proposal negotiation.

Herbert B. Goodwin is a program manager on the headquarters staff of the Defense Contract Audit Agency. He has served in the Government since 1953 including over 10 years with the U. S. Army Audit Agency. Mr. Goodwin is a graduate of the City College of New York and is a certified public accountant.

Validation of Savings

Now we turn to the other major audit effort associated with the value engineering program, namely, validation of value engineering savings reported to the Cost Reduction Program.

It is interesting to note that the audit work involved in validation of cost reductions involves some of the same problems as VECP audits. It is far from simple to distinguish value engineering from other functions which are similar, and to price out the benefits of value engineering projects. However, prior to any discussion of how claimed value engineering savings are audited in the Defense Department Cost Reduction Program, it is appropriate to review some of the more important provisions of the reporting instruction (DOD Instruction 7720.6) which was revised in May 1967.

From an audit viewpoint, the revised instruction made some important criteria changes in the value engineering area. These changes clarify some of the provisions which used to create disputes between auditors and program monitors. One example is the scope of the area which has been redefined. The old instruction seemed to limit the scope of the value engineering area to the elimination of unessential technical requirements for systems, facilities, equipment and materiel. Now the scope is defined as a systematic effort directed at analyzing any function, for the purpose of achieving the function at the lowest cost consistent with the requirements for performance and reliability. Another change in the instruction is the provision that there must be a written value engineering proposal before an action may be reported in the value engineering area. This was not a requirement in the old instruction, and there were many arguments as to whether or not certain cited actions represented reportable value engineering in the program.

Another new rule is that savings on contracts, which result from unilateral Class II changes, may be reported only when the savings result directly from a value engineering program on a specific contract which is funded as a separate line item in that contract. As is generally recognized, there were many problems in the past regarding the eligibility of Class II changes. While this new provision may not eliminate all the problems, it undoubtedly will reduce their number.

Also, the new instruction now spells out the prescribed time for reporting value engineering savings. The special guidance for the value engineering area includes detailed instructions for both in-house savings and savings on contracts with others. Briefly, the new provisions are that, for items produced or services performed in-house, the savings are reportable when the value engineering proposal has been approved and implemented; savings on existing government contracts normally will be reported when the value engineering proposals have been approved, and the contractor is notified to implement the proposals. If the value engineering action affects an item or services procured after final approval of the value engineering proposal, the action will be reportable in the year the procurement contract is awarded.

The Cost Reduction Audit

So much for the revised instruction. Now the methods employed in validating the savings can be discussed. Like most other types of audits, the cost reducton audit is made on a selective basis. This means that the auditors do not make a detailed audit of all savings actions. To do so would be impractical, if not impossible, because many thousands of savings are reported each year. These range from very small to very large savings. To obtain the desired confidence level, all large savings (over a prescribed dollar amount) are audited in enough detail to substantiate their eligibility and amount. A limited number of smaller savings, in dollar amounts below the prescribed threshhold, also are audited in some detail. These savings are first desk-reviewed, and those which clearly fail to meet program criteria are rejected. Of those which seem to qualify, a small number are picked for further audit examination, and

the others are accepted without further audit. If the detailed audit of the selected savings shows faulty procedures or incorrect reporting, the size of the sample is increased. The foregoing audit scope takes in the bulk of the total dollars reported, and provides an adequate basis for an audit opinion on the overall reliability of the cost reduction system and the reasonableness of total savings reported.

The results of the Cost Reduction Program are widely publicized, both within and outside of the Defense Department. Therefore, it is essential that claimed savings be defensible. If not, the results could be very embarrassing to DOD and its officials. To guard against such an event, only audited cost reduction reports are submitted to the Secretary of Defense. To make sure that the audits are timely, a very high audit priority has been assigned to the Cost Reduction Program. The audit is performed on a continuous basis so that the review is completed by the time the cost reduction reports of accomplishments are issued.

The audit organizations of the Military Departments and the Defense Agencies perform their respective audits. This work is done under detailed guidance issued by the heads of each audit office, and is specifically tailored to the needs of each DOD component. Overall policy guidance is furnished by the Assistant Secretary of Defense (Comptroller) in DOD Instruction 7600.14. The consolidated DOD Cost Reduction Reports, issued by the Office of the Assistant Secretary of Defense (Installations and Logistics), are reviewed by the Office of the Deputy Comptroller for Audit Systems which is a part of the Office of Assistant Secretary of Defense (Comptroller). For all practical intents and purposes, complete reliance is placed on the auditing done within the DOD components; however, the Office of the Deputy Comptroller for Audit Systems does review some of the larger or more sensitive looking items, and occasionally reviews actions which are in dispute between the program monitors and the auditors of the DOD components.

Naturally, there may be some differences in the details of the audit instructions issued by the DOD audit organizations. However, the general approach to the audit is the same. Field auditors review individual savings claims at the levels where the actions are taken. Where it is necessary to examine the records of a defense contractor, the Defense Contract Audit Agency performs an assist audit.

As individual savings reports are forwarded through command reporting channels and included in report consolidations, the larger savings are desk-reviewed by supervisors who also review the consolidated reports. Finally, the cost reduction project auditors of the DOD component head quarters review the overall departmental consolidation. There have been some complaints about the number of higher echelon audit reviews. However, they are needed to insure uniformity within a DOD component in the auditor's interpretation of program criteria and audit guidance. Incidentally, the reviews at higher levels do not necessarily result in rejecting savings which were validated at lower levels. They often result in accepting savings which were nonvalidated at lower echelons.

One point that should be made is that a great deal of judgment is involved in this audit, not only in determining whether an action meets program criteria but also in assessing the adequacy of supporting documentation. Obviously, it would be undesirable to create new, elaborate systems and documentation just for cost reduction purposes. Accordingly, auditors are required to consider the intent of the program, to be objective in interpreting program criteria, and to be realistic in their requirements for supporting documentation. Where a saving results from a conscious management action that appears to meet the objective of the program, it generally will be accepted by the auditors even though it could be questioned on the basis of some technicality. However, if the calculation of the saving involves estimates, it is expected to be on the conservative side. On the other hand, the auditors must be assured that the savings are supportable and will stand up under outside, critical review. Therefore, if funds are saved by happenstance and the savings cannot be shown to be the result of a new, improved, or intensified management action, the auditor will reject the claim.

Many may wonder about the necessity for having auditors police the reporting of program accomplishments. From the very beginning, Secretary McNamara insisted on an independent audit, and assigned the responsibility to the Assistant Secretary of Defense (Comptroller). As indicated in the last report to the President, Secretary McNamara also arranged for the General Accounting Office to review the program. Obviously, this adds to our incentives to report only good savings which qualify under the rules of the program.

No matter how good the preliminary screening becomes, this program does invite differences of opinion. Since situations are hardly ever clearly black or white, it would be surprising indeed if the auditors were never found guilty of turning down savings which the program monitor is convinced are valid. If this should happen, it is well to remember that the auditor is not the final judge and jury. There is a clearly defined procedure for submitting disputed actions for review. This procedure is described in DOD Instruction 7720.6. Where program monitors are convinced that a saving is valid but cannot get audit acceptance at their level, the disputed action is referred to the next higher level of command—all the way up to the Departmental Secretary or Agency Director, if necessary. Where differences cannot be resolved even at the highest level of a DOD component, the cases will be referred to the Office of the Secretary of Defense for resolution.

As may be seen from this description, the DOD Cost Reduction Program has received a great deal of audit emphasis. Undoubtedly, there are cases in which those responsible for meeting savings goals are disappointed because one of their savings is declared ineligible for reporting. However, all responsible program managers are convinced that a strong, independent audit is essential to the effectiveness and credibility of the program.

SecDef Reports Defense Industry Support of Cost Reduction Program

[Editor's Note: The following is a memorandum dated Dec. 22, 1967, addressed to President Lyndon B. Johnson by former Secretary of Defense McNamara, reporting on the Defense Contratcor Cost Reduction Program.]

It is now four years since you requested defense contractors to assist in reducing defense expenditures by expanding and intensifying their cost reduction efforts on defense business. The voluntary Defense Contractor Cost Reduction Program was formalized three and one-half years ago to provide a channel for communicating the results of these intensified efforts. The achievements reported since then by these contractors demonstrate clearly that defense industry has given unqualified and continuing support to your stated objective. Cost reduction and management improvement have become a permanent way of life with a major segment of the defense industry community.

Reporting Companies

Today 85 parent companies [listed on page 13] are active participants in the Defense Contractor Cost Reduction Program—an increase of 13 percent over FY 1966. They have 211 plants or divisions (an increase of 15 percent) which report to us semi-annually. In FY 1967, these companies received more than half of the $39.8 billion awarded by the Defense Department to business firms for work in the United States.

Savings to Defense

Participating contractors report to us the savings they have effected by reducing costs, without sacrifice of requisite quality and reliability. These savings result from improved management techniques, procedures, or processes. Savings reported relate to defense sales, exclusive of firm fixed-price contracts. In the year ending June 30, 1967, participating contractors reported savings of $972 million on these defense sales, which totaled $12.4 billion. In the two prior years of formalized reporting, they reported $1.8 billion in savings for a three-year total of over $2.7 billion. These are direct savings to the Defense Department, since they represent the elimination of costs which otherwise would have been reimbursed.

Benefits to Industry

In addition to contributing to your national objective of "a dollar's value for every dollar spent," defense industry considers cost reduction to be in its own best interest. The increased emphasis by the Defense Department on the use of incentive-type contracts, competitive procurement and the application of value engineering techniques encourages defense industry to stress cost reduction and management improvement.

The trend of the late fifties and very early sixties towards greater use of cost-plus-fixed-free contracts by the Defense Department has been sharply reversed over the past six years. This type of contract, which is usually justified only when there are great uncertainties involved, offers neither reward for good performance nor penalty for bad. The proportion of cost-plus-fixed-fee contracts awarded by the Defense Department has been reduced from a high of 38 percent in FY 1961 to 10.4 percent at the end of FY 1967.

During the same period of time, the precentage of total procurement dollars awarded on a price competitive basis by the Defense Department increased from 32.9 percent to 42.9 percent.

North American Rockwell Corp., in its latest annual report to stockholders, discussed today's defense contracting environment:

> **While the combined volume of business in these two fields of defense and space continues to be high, we are also entering a period of new opportunities for greater returns on this business. In the current trend away from cost-plus-fixed-fee contracts, almost all North American's work in the 1967 fiscal year will be under fixed-price or incentive-type contracts. These involve both higher risks and the possibility of higher returns.**

The Defense Department has also increased financial incentives to encourage defense contractors to seize every opportunity to eliminate non-essential design and performance features through value engineering. Recent departmental regulations have improved these contractual incentives by:

- Expanding the opportunities for a contractor to earn a greater share of his value engineering savings—in some cases to over 50 percent.
- Sharing the costs of developing a value engineering change proposal with the contractor where appropriate.
- Shortening the time a contractor must wait for payment of his share of the savings.

In addition to the incentives being offered by the Defense Department, corporate executives are motivated because they consider an effective cost reduction program essential to stay competitive and earn reasonable profits. A successful program also enables top management to demonstrate its cost consciousness to stockholders, customers and the general public.

Curtiss-Wright Corp. summarized the benefits from its broad management improvement programs in its latest report to stockholders:

> **These programs have consolidated functions and operations, reduced costs, increased efficiency, rechanneled our capabilities, and materially strengthened the competitive position of Curtiss-Wright.**

In its most recent annual report, Lockheed Aircraft Corp. discussed cost reduction techniques, as well as benefits:

The third year of the intensified cost reduction campaign sponsored by the government in defense and space industries once again showed improvement . . . Savings are shared with the government and are used to strengthen our competitive position. They result from improved management techniques, computer aids, automation, process innovation, value engineering, and the Zero Defects quality improvement program.

Examples

Following are examples of savings reported by contractors during the year ending June 30, 1967:

Bell Aerospace Corp.

Bell Helicopter Co. eliminated fuel lines and jettison cables for auxiliary fuel tanks as "built-in" equipment on the UH-1D helicopter. This change resulted from a value engineering analysis which disclosed that the auxiliary fuel tanks were used only for ferrying operations. The desired ferry capability was obtained by including these lines and cables in a relatively small number of auxiliary fuel tank modification kits. Elimination of this equipment from production aircraft saved the Army $97,047. In addition, the action significantly reduced aircraft weight.

General Electric Co.

General Electric's Defense Electronics Division is now providing new-type 25,000-hour miniature indicator lamps as replacements for 7,000-hour lamps in the display panels aboard Polaris fleet ballistic missile submarines. Use of the new lamps in the display panels of the 41-ship Polaris-Poseidon weapon system will mean 1,760 fewer lamp replacements per submarine per year. One-year savings to the Navy on current supply contracts totaled $19,321. The Navy will realize even greater benefits in reduced fleet operational maintenance.

Goodyear Aerospace Corp.

Goodyear recommended substituting special-purpose photographic units costing $8,804 each for units costing $20,263 each which were originally specified in an Air Force contract for mobile photographic facilities. Joint evaluation of the two units by Goodyear and the Air Force revealed that the lower-cost unit was equal to, and in some features superior to, the more expensive one in performance and design. This change saved the Air Force $586,591.

Lockheed Aircraft Corp.

Lockheed Missiles and Space Co. changed from a lease arrangement with the manufacturer to an installment purchase contract for a digital computer, as a result of an analysis of all company computer costs. Savings totaled $206,292.

North American Rockwell Corp.

Autonetics Division centralized the shipping functions of its three product divisions on the basis of a systems and facility study. Operating costs were reduced $327,800 by consolidating shipments, improving manpower utilization, and reducing material requirements.

Olin Mathieson Chemical Corp.

The Indiana Army Ammunition Plant mechanized a propellant load line used in the production of the Charge M67 for the 105mm gun. Fully amortized equipment on hand from a previous operation was modified and combined with new equipment for the mechanized operation. Savings to the Army over the prior manual operation totaled $770,408.

Philco-Ford Corp.

Philco-Ford's Aeronutronics Division replaced an aluminum sand casting used in the Shillelagh missile flight control housing with a less expensive permanent mold casting and saved $698,243. The division also substituted a metal film resistor for a more expensive but less reliable wire bound resistor in the missile's control assembly and saved an additional $108,793.

Raytheon Co.

Raytheon substituted molded plastic assemblies for individually machined steel assemblies used in the production of the M905 bomb fuze. The saving on 1,400,000 fuzes was $232,500.

Remington Arms Co., Inc.

The Lake City Army Ammunition Plant reduced the size of the carton for the 5.56mm M193 ball and M196 tracer cartridge and eliminated a tray previously specified for use with the carton. As a result, each packing box now holds 41 cartons (820 cartridges) instead of 36 cartons (720 cartridges). Reduced material costs for the cartons and reduced requirements for packing boxes and crates saved $414,833.

Joint Defense-Industry Workshops

During February-April 1967, a series of joint Defense-industry regional workshops was held to discuss mutual problems and interests concerning the Defense Contractor Cost Reduction Program. Over 1,000 industry and Defense Department representatives attended. At these meetings, working level cost reduction personnel from both industry and the Defense Department were brought face-to-face. Panel meetings at each workshop examined selected areas in depth. A specific conclusion was that the Contractor Program Guidelines issued in May 1964 are still working well.

The Board Chairman of one of the largest defense contractors, in a letter to the Defense Department, stated:

In further regard to the subject of motivation, we feel that the recent Defense-Industry Joint Regional Cost Reduction Workshops contributed significantly to even better working relations between DoD and the contractors, and to a more complete understanding of mutual problems and objectives.

We agree and plan to schedule joint Defense-industry cost reduction meetings annually.

Future of the Program

I believe the record of the voluntary participants in the Defense Contractor Cost Reduction Program is clear evidence of the defense industry's accomplishments and sustained interest in support of our objective of conserving defense resources.

You may be sure that we in the Defense Department will continue to work closely with our defense contractors to capitalize on every opportunity for increased economy in Government.

Alphabetical Listing of Parent Companies Participating in Defense Contractor Cost Reduction Program

AAI Corp.
Aerojet-General Corp.
American Air Filter Co. Inc.
American Bosch Arma Corp.
ARO, Inc.
Atlantic Research Corp.
Atlas Chemical Industries, Inc.
Avco Corp.
Beech Aircraft Corp.
Bell Aerospace Corp.
Bendix Corp.
Boeing Co.
Burroughs Corp.
Collins Radio Co.
Computing and Software, Inc.
Continental Aviation and Engineering Corp.
Control Data Corp.
Cornell Aeronautical Laboratory, Inc.
Curtiss-Wright Corp.
Day and Zimmermann, Inc.
Dynalectron Corp.
Electronic Communications, Inc.
Electro-Optical Systems, Inc.
Fairchild Camera and Instrument Corp.
Federal Cartridge Corp.
FMC Corp.
Garrett Corp.
General Dynamics Corp.
General Electric Co.
General Motors Corp.
General Precision Inc.
Goodyear Aerospace Corp.
Grumman Aircraft Engineering Corp.
Gyrodyne Co. of America, Inc.
Harvey Aluminum Sales, Inc.
Hayes International Corp.
Hercules, Inc.
Holston Defense Corp.
Honeywell, Inc.
HRB-Singer, Inc.
Hughes Aircraft Co.
Hycon Manufacturing Co.
International Business Machines Corp.
International Harvester Co.
International Telephone and Telegraph Corp.
Interstate Electronics Corp.
Johns Hopkins University
Lear Siegler, Inc.
Kaiser Jeep Corp.
Ling-Temco-Vought, Inc.
Litton Systems, Inc.
Lockheed Aircraft Corp.
Loral Corp.
Magnavox Co.
Marquardt Corp.
Martin Marietta Corp.
Mason and Hanger—Silas Mason Company, Inc.
Massachusetts Institute of Technology
Maxson Electronics Corp.
McDonnell Douglas Corp.
Melpar, Inc.
Mitre Corp.
Motorola Inc.
Newport News Shipbuilding and Dry Dock Co.
North American Rockwell Corp.
Northrop Corp.
Olin Mathieson Chemical Corp.
Page Aircraft Maintenance, Inc.
Pan American World Airways, Inc.
Philco-Ford Corp.
Radiation, Inc.
Radio Corp. of America
Raytheon Co.
Remington Arms Co., Inc.
Ryan Aeronautical Co.
Sperry Rand Corp.
Sylvania Electric Products, Inc.
Thiokol Chemical Corp.
TRW, Inc.
UNIROYAL, Inc.
United Aircraft Corp.
Vitro Corp. of America
Western Electric Co., Inc.
Westinghouse Electric Corp.
Whittaker Corp.

Annual Symposium of IEEE Scheduled for May 6 and 7

"Human Factors in Electronics" will be the theme of a two-day symposium and exposition to be sponsored by the Man-Machine Systems Group, Institute of Electrical and Electronics Engineers, on May 6 and 7 at the Marriott Twin Bridges Motor Hotel in Washington, D.C.

The symposium will include four technical sessions, four panel discusssions and two luncheons.

The program will feature discussions and displays dealing with human factors in Government, aircraft cockpit displays, perception and response, systems analysis and modeling, man machine control systems, aviation and space applications, and use of simulators in traffic safety.

Attendance at the sessions and exposition is encouraged from agencies of the Federal Government, the Military Departments and research firms. No registration fee will be charged for attendance at the exposition.

For further information contact Rube Chernikoff, General Chairman, Department of Transportation, 412-B Donohoe Building, Washington, D.C. 20591, Phone (202) 962–8337.

Advanced Ballistic Missile Defense Agency Established

The Army will establish an Advanced Ballistic Missile Defense Agency, which will combine some elements of the Defense Department's Advanced Research Projects Agency (ARPA) Office of Ballistic Missile Defense and advanced development of the Nike-X.

Dr. Patrick J. Friel, current Director of ARPA's Office of Ballistic Missile Defense, will be appointed as Deputy Assistant Secretary of the Army and will serve a Director of the Advanced Ballistic Missile Defense Agency.

ARPA will continue to pursue research and studies in the area of advanced strategic technology. Dr. David E. Mann will direct the activities of the ARPA office.

Standardization of Components/Equipment in the Naval Material Command

Harry Dickinson

Effective fleet operations hinge on the readiness and performance of equipment, as well as on the men who man it. Ship commanders have made the Washington level acutely aware of problems stemming from a lack of hardware standardization. Typical is an excerpt from a letter received from the Fleet: "The lack of standardization causes a multitude of problems to the type comanders. Already 30 percent of the hull, mechanical and electrical allowance parts apply to only one ship. Logistic support is more expensive, repair parts are prolonged (receipt-wise), libraries, instruction books and drawings expand, the training of shipboard and yard personnel is complicated."

Reliability and maintainability have been stressed in hardware design and acquisition, and to a lesser degree so has supportability—the ability to acquire and provide repair parts in the right quantity in time to meet demand. The wider and more diverse the range of equipment in use, the more costly and difficult is repair part support. This theme is axiomatic and the operational level consistently voices it.

With recognition of the need for improvement in the acquisition and management of hardware, in May 1966 the Navy's bureau structure was revamped. This was marked by changes so deep that they required the term "material bureau" be discarded. To spread the acquisition and management of naval material more evenly, four bureaus were replaced by six systems commands:

Naval Air Systems Command
(NAVAIR)
Main Navy Building
Washington, D. C. 20360

Naval Electronics Systems
Command (NAVELEX)
Munitions Building
Washington, D. C. 20390

Naval Facilities Engineering
Command (NAVFAC)
Yards and Docks Annex
Washington, D. C. 20390

Naval Ordnance Systems
Command (NAVORD)
Munitions Building
Washington, D. C. 20390

Naval Ship Systems
Command (NAVSHIPS)
Main Navy Building
Washington, D. C. 20360

Naval Supply Systems
Command (NAVSUP)
Main Navy Building
Washington, D. C. 20360

Concurrent with the reorganization, and consonant with the theme of improving logistic support, the Chief of Naval Material established a permanent staff for component/equipment standardization and configuration management reporting directly to the Deputy Chief of Naval Material (Logistic Support), formerly Rear Admiral J. D. Arnold, now Rear Admiral Nathan Sonenshein. This staff operates under the direction of Captain W. Seith, USN.

The profound interrelation of standardization and configuration management is worthy of note. Configuration management (see article, "Configuration Management in the Navy." *Defense Industry Bulletin*, Volume 3, No. 4, April 1967, page 4), through its requirements for configuration control, accounting and identification, reinforces the controls that maintain both standardization and the identification necessary for programming retrofit of standard items into non-standard installations.

The backdrop for promoting greater standardization included findings of various studies and reports developed by the Logistics Management Institute (LMI) as well as internally by the Navy. The findings

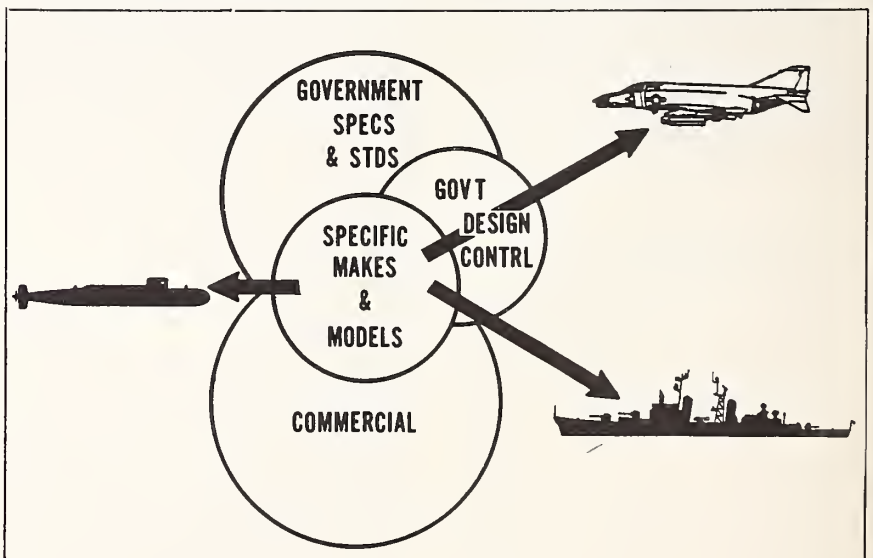


Chart I

emphasized the equipment proliferation problems being encountered in the Fleet. This proliferation, or multiplicity of makes and models of components/equipments used to serve the same purpose—functionally the same, but having different internal parts, was attributed to a lack of standardization in design and procurement. Components/equipments, as referred to herein and defined under the scope of the Navy's program, are repairable items requiring repair part support.

Concrete evidence exists on the scope of the proliferation. For example, Navy's Allowance Parts Lists (APLs), listings of distinct repair parts for the different hull, mechanical, electrical components/equipments supported in the active Fleet, include 40,000 different sizes, types, varieties and kinds of valves. The quantity of valves, which supports the approximately 1,100 ships in the Fleet, is actually a multiple of the total number of different types of commercial valves available from industry. Valves represent an area to be subjected to early standardization treatment. There are many other commodities covered by APLs. Approximately 159,000 different components/equipments are currently required for fleet support, serving in the neighborhood of two million applications within the previously mentioned 1,100 hulls. These population data for shipboard components/equipments are registered in the files of the Ships Parts Control Center (SPCC), Mechanicsburg, Pa., the inventory control point for hull, mechanical, electrical items.

Government specifications and standards (see Chart 1) as a rule do not specify internal parts interchangeability but provide for form/fit function requirements. Government design control data packages generally provide for parts interchangeability; however, there are exceptions—mainly in the electronics area where the packages cite circuit symbol data which do not necessarily provide parts interchangeability. As discussed later in this article, NAVELEX is surveying standardization requirements for electronics. The vast universe of commercial equipment available also tends to mitigate against parts interchangeability.

The program for component/equipment standardization is working toward controlling the multiplicity of makes and models in and entering the Fleet. The tendency shall be an orderly orientation toward specific makes and models which have proven reliability and are supportable with a depth of repair parts.

The Navy has developed policy which has been issued from the Chief of Naval Operations level and promulgated throughout the Naval Material Command by the Chief of Naval Material. This policy, stated broadly, requires that the hardware system commands:

- Standardize designs—with inter- and intra-system standardization.
- Re-use in new design existing component/equipment already supported in depth.
- Preclude use of limited application and poor performance component/equipment.
- Exercise stringent change control.
- Use procurement techniques to restrain proliferation.
- Standardize items (parts), materials, processes and services.
- Effect item entry control in design selection and provisioning.

Top level policy is a firm foundation for proper program execution. The Navy's policy was buttressed when the President issued his memorandum of Sept. 16, 1966 (see Chart 2), directing the heads of departments and agencies to improve management and procurement of government property and hardware. The executive memorandum emphasizes the words "make do." The Navy policy for re-use in new design and standardization of components/equipments will facilitate use of existing repair part ranges and effect required management savings. Program implementation is progressing well:

- NAVELEX has issued its implementing instruction (NAVELEXI NST 4120.1) which was developed under the leadership of Frank Berg, Electronics Standards Office (ELEX–OOT), NAVELEX. Specific tasks are being milestoned within that command.
- NAVSHIPS is correlating the standardization tasks it has under way and has an advanced draft of a comprehensive implementing instruction. Morris Alpert, Standardization Branch (NAVSEC–6033), Technical Concepts and Methods Office, Naval Ship Engineering Center (NAVSEC), is coordinating this effort within the Washington headquarters of NAVSEC. Significant input is being provided by the NAV SEC Mechanicsburg Division, which is headed by Captain Carl B. Ihli, USN, (see article, "Standardization—The Answer to the Fleet Spare Parts Dilemma," *Defense Industry Bulletin*, Volume 4, No. 1, January 1968, page 1).

STANDARDIZATION

THE WHITE HOUSE
WASHINGTON

September 16, 1966

MEMORANDUM TO THE HEADS OF DEPARTMENTS AND AGENCIES

"... I want a special sustained Government-wide effort started immediately to improve the procurement and management of property. Each of you is requested to-

"... eliminate procurement of items being requested only to satisfy a desire for latest styles or designs. The entire organization must be instilled with a "make do" attitude....

"In furtherance of this effort, the Secretary of Defense and the Administrator of General Services will....

".... accelerate efforts to reduce the number of items in the Government's supply systems by (1) establishing effective controls to prevent new items from entering the supply systems unless they are essential, and (2) by developing standards and requiring that standard items be used and that items which have unnecessary nonstandard features are eliminated from the system ...."

/signed/ LYNDON B. JOHNSON

Chart 2

• NAVAIR plans are in approximately the same stage of development as NAVSHIPS. Frank B. Ingham, Standardization Section (NAVAIR–52021), Technical Support Branch, Engineering Division, NAV AIR, is guiding this effort with significant input from the Weapons Engineering Standardization Office (WESO), Philadelphia. Norman Raditz, WESO, is providing engineering liaison and expertise. The Aviation Supply Office, Philadelphia (Phil Jensen, coordinator), is assisting by providing statistical information on component/equipment application and population.

• NAVORD has developed preliminary planning and is preparing implementing instruction. This task is being coordinated by Tom McGee, Standardization Branch (NAVORD–9343), Engineering Support Division, NAVORD.

• NAVSUP has issued its plan which primarily treats with materials handling equipment, the major hardware area under NAVSUP cognizance.

• NAVFAC has established a task group to review procurement/standardization practices within that command. This group is headed by Captain W. A. Walls, CEC, USN, Assistant Commander for Engineering and Design, NAVFAC.

Some of the specific actions taken to date include the following:

• New techniques employed by the Fast Deployment Logistics (FDL) Ship include the development and use of a Standard Component List (SCL) for design selection of shipboard components/equipments. The SCL lists those reliable, in-service components/equipments having application to three or more ships of the active fleet. It, or variations thereof, will also be applied during design of the new nuclear aircraft carrier (CVAN–68), the Large General Purpose Amphibious Assault Ships (LHAs) and, possibly, the new destroyer/destroyer escorts (DX/DXGs).

• Ship identicality is being programmed by conformance with a Five-Year Design Objective (FYDO) which phases major ship changes to an optimum standardiaziton advantage.

• Multi-ship / multi-year procurement has resulted in application of specifications requiring identicality within the buy.

• Central procurement of identical components/equipments by "lead-yards" for "builds" in more than one yard has strong potential for constraining make and model proliferation.

• Standardization contract clauses have been placed in over $700 million worth of new construction contracts, giving incentives of up to $200,000 per ship for using 90 percent or more of components/equipments already installed in the active fleet.

• Requirements have been placed in ship specifications so that machinery and equipment, which are functionally interchangeable, will be identical within the same ship.

• Life cycle costing—not just low bid, but least cost to the Government for entire life cycle, including chief costs, associated with new support parts, new drawings and manuals, training and test equipment, and increased maintenance—is being applied progressively in procurement of components/equipments.

In the area of provisioning, the Navy is working with the Department of Defense Item Entry Control Office to further the ongoing effort to control item entry in the military supply system. A network of Defense Technical Review Activities (DTRAs) has been set up to screen new item input from provisioning to determine parts interchangeability relationships, and to match out actual duplicate items which may have been hidden by differing identification or technical data. These review activities are located within the Military Departments and the Defense Supply Agency complex. They operate under single Service assignment by Federal Supply Class (FSC). For example, the Aviation Supply Office in Philadelphia has a data bank of identification cards, drawings, catalogs, etc., for all parts used by the four Services in FSC 2840—Aviation Gas Turbine and Jet Engines and Components thereof. All new parts entering the military supply system in that FSC go to the Aviation Supply Office for a technical characteristics screen prior to the assignment of Federal Stock Numbers. It is the responsibility of the Aviation Supply Office to match out and control item duplication within the class.

With application of such new DOD management techniques as integrated logistic support, concept formulation, and contract definition, engineering and procurement are being treated less like discrete functions. This development permits interweaving of standardization as a good busi-

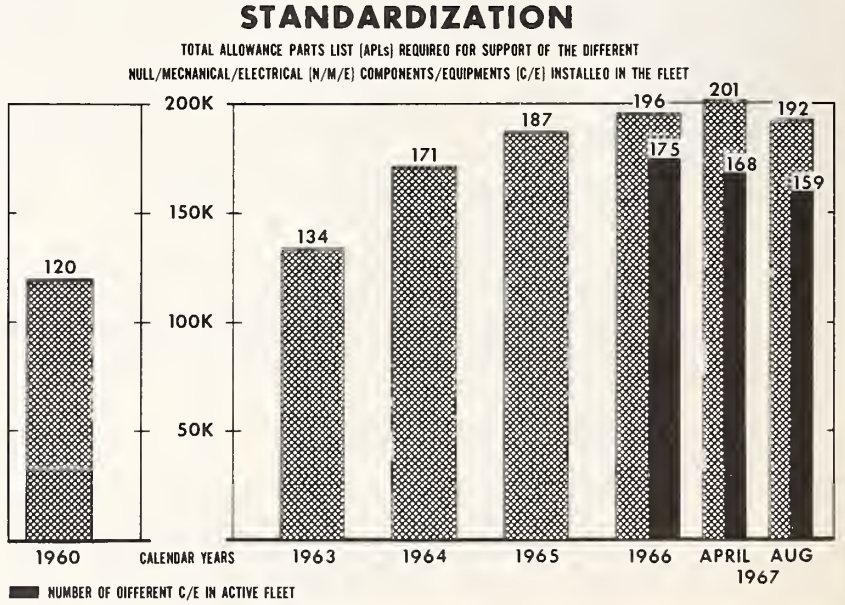


Chart 3

ness practice throughout the fabric of hardware acquisition. The Navy program has two immediate objectives:

- Full implementation of the standardization policy of the Office of the Chief of Naval Operations and the Naval Material Command.
- Increased visibility of each system command's standardization posture *viz.*, the proper presentation of quantitative data showing the population of different components/equipments—Chart 3 is an example). This visibility permits pinpointing trends requiring special standardization treatment.

Standardization shall be considered whenever a potential exists for using it as the mechanism for improving supportability of military hardware. Engineering and procurement latitude permit its application without foregoing technological advance and requisite competition.

The continuing goal shall be to stem proliferation and, by backfitting and attrition of non-standard components/equipments, reduce the great complications inherent in supplying wide ranges of different things to the Fleet.

Harry Dickinson has served as the senior technical associate for standardization under the Director of Standardization and Configuration Management, Naval Materiel Command, for the past 18 months. He has also served with the Engineering Branch of Naval Material Command and with the Bureau of Supplies and Accounts.

FY 1969 Request for Military Construction Submitted to Congress

The Defense Department has submitted to the Congress a military construction authorization bill for FY 1969 totaling $1,877,687,000, requesting new authorization in support of the Military Services, the Defense Agencies, and the Reserve components.

The projects for which authorization has been requested are located at 321 military installations in the United States, and at overseas bases in the Caribbean, Europe, Pacific Islands, Japan, Korea and Southeast Asia.

Primary objective of the proposed new construction is to strengthen and improve the combat readiness and capabilities of military land, sea and air forces wherever they are stationed, and to provide them with the modern facilities required to support the advanced weapons and defensive systems with which they are equipped.

Additionally, this FY 1969 Military Construction Authorization Program contains $227.3 million for construction of facilities in support of the Sentinel Anti-Ballistic Missile System on which a deployment decision was announced last September.

Also included in the total authorization request is $589,700,000 for military family housing, and $11,800,000 for homeowners assistance. New family housing accounts for $42,850,000 of this total amount and contemplates the construction of 2,000 units in the United States. The balance represents continuing requirements necessary for maintenance and operation, improvements to existing mortgages, leasing costs, and payments of principal and interest on mortgage obligations.

The table below presents details concerning the major elements in dollars for the authorization requested:

	United States Locations	Overseas Locations	Locations Not Specified	Total
Army	$363,980,000	$242,474,000	$ 10,000,000	$ 616,454,000
Navy	251,613,000	62,651,000	10,000,000	324,264,000
Air Force	153,603,000	71,866,000	10,000,000	235,469,000
Reserve Components	16,300,000	—	—	16,300,000
Defense Agencies	13,051,000	649,000	70,000,000	83,700,000
Subtotal	$798,547,000	$377,640,000	$100,000,000	$1,276,187,000
Military Family Housing	—	—	—	589,700,000
Homeowners Assistance	—	—	—	11,800,000
Total	$798,547,000	$377,640,000	$100,000,000	$1,877,687,000

New Thesaurus of Scientific Terms Available

A new comprehensive Thesaurus of Engineering and Scientific Terms (TEST), published jointly by the Defense Department and the Engineers Joint Council, is now available.

The result of a 29-month collaborative effort, the 176-page thesaurus is an interdisciplinary vocabulary of more than 23,000 main terms. The book standardizes language used to index scientific and engineering information.

Organizations registered with the Defense Documentation Center may obtain copies by requesting the Thesaurus of Engineering and Scientific terms (TEST). Other interested parties may purchase copies from the Engineers Joint Council, 345 E. 47th St. New York, N.Y. 10007, for $25 a copy.

Public Affairs Liaison with Industry Instruction Published

The Defense Department has issued DOD Instruction 5410.20, "Public Affairs Liaison with Industry," dated Feb. 9, 1968, which provides guidance and procedures governing DOD cooperation with industry in public affairs matters in general, industry-sponsored events, and in advertising defense themes and products.

The objective of the instruction is to assure understanding by American industry—particularly defense contractors—of the plans, programs and activities of DOD through wide dissemnination of information consistent with national security, and through cooperation with industry in public relations activities, which are not contrary to national or DOD interests. In accordance with this objective, DOD components are encouraged to cooperate with industry at local and regional levels. Such cooperation must conform to the provisions of DOD Directive 5410.18, "Community Relations," dated Feb. 9, 1968, which states that "Department of Defense participation and cooperation must not directly or indirectly (a) endorse or selectively benefit or favor, or appear to endorse or selectively benefit or favor, any private individual, sect, fraternal organization, commercial venture. . . ." DOD components are required to advise the Assistant Secretary of Defense (Public Affairs) of any local or regional activity which has the potential of being escalated, or which has been escalated by unforeseen circumstances, to national or international interest.

Implementation of the provisions of DOD Instruction 5410.20 is the responsibility of the Business and Labor Division, Directorate for Community Relations, Office of the Assistant Secretary of Defense (Public Affairs). The Business and Labor Division was established in July 1964 to serve as a point of contact at the seat of government for public affairs communication between the Defense Department and the business and labor communities. Organization and personnel assigned to the division are shown in Figure 1.

The Business and Labor Division is responsible for developing and directing continuing liaision programs designed to keep industry, defense-oriented associations, and labor organizations informed on the policies, objectives and activities of DOD and its components. In addition, it works with representatives of these groups on public affairs projects and programs of mutual interest, and coordinates the participation of the organizational elements of the Office of the Secretary of Defense, as well as those of the Military Departments and Defense Agencies, in public information programs and activities of the business and labor communities.

The publication in which this article is published, the *Defense Industry Bulletin*, is one of the services offered by the Business and Labor Division to the industrial community. The Bulletin serves as a means of communication from DOD and its components to industry. Published monthly and distributed without cost, the magazine's purpose is to provide information on DOD policies, procedures and activities and to stimulate thought by members of the defense-industry team in solving the problems that may arise in fulfilling the requirements of national security.

Cooperation and assistance provided to industry by the Business and Labor Division, under the provisions of the instruction, include such industry-sponsored events as meetings, exhibits, and public ceremonies. Industry participation in DOD-sponsored events is also included. Guidance on the use of DOD insignia, themes and products in advertising, and motion picture production is also provided.

The new instruction does not in any way alter the policies and procedures relating to defense contracting activities as stated in the Armed Services Procurement Regulation, the Industrial Security Manual for Safeguarding Classified Information, or any other official DOD publication.

Business and Labor Division
Directorate for Community Relations
Office of Assistant Secretary of Defense (Public Affairs)

Room 1E 764, The Pentagon
Washington, D.C. 20301

Capt. John A. Davenport, USN
Chief, Business and Labor Division
(202) OXford 5-0208

Business Activities Office
(202) OXford 5-2036 or OXford 5-2733

Lt Col. Travis M. Gafford, USA ---------- Business Activities Officer
Mr. Rick La Falce ---------- Business Activities Specialist

Labor Activities Office
(202) OXford 5-2733

Mr. William P. Welsh ---------- Labor Activities Specialist

Defense Industry Bulletin
(202) OXford 5-2709

Lt. Cdr. E. W. Bradford, USN ---------- Editor
Mrs. Cecilia Pollok McCormick ---------- Associate Editor
Capt. Frank W. Kafer, USAF ---------- Associate Editor

Figure 1.

ABOUT PEOPLE

DEPARTMENT OF DEFENSE

Dr. Stephen J. Lukasik has been appointed Dep. Dir., Advanced Research Projects Agency. Dr. Lukasik has been serving as Acting Dep. Dir.

William K. Brehm has been sworn in as Dep. Asst. Secretary of Defense (Land Forces Programs), Office of the Asst. Secretary of Defense (Systems Analysis). The position was elevated to deputy secretary level in October at which time Mr. Brehm assumed the position of Acting Dep. Asst. Secretary.

Maj. Gen. Donald R. Pierce, USA, has been named Commander, Test Command, Defense Atomic Support Agency, and Commander, Joint Task Force Eight. Both commands are located at Sandia Base, Albuquerque, N.M. He succeeds **Maj. Gen Arthur W. Oberbeck, USA.**

RAdm Robert H. Weeks, USN, has been assigned as Vice Dir., Defense Communications Agency, Arlington, Va., succeeding **Maj. Gen. George E. Pickett, USA.**

Col. George F. Hamel, USA, has succeeded **Col. Joel B. Stephens, USA,** as head of the Directorate for Community Relations, Office of the Asst. Secretary of Defense (Public Affairs). Col. Hamel moved up to the position from duty as chief of the Veterans & Civic National Organizations Division. Col Stephens is the new Public Information Officer at the U. S. Military Academy, West Point, N. Y.

Col. Norman H. Gold, USA, has been named Dir. of Freight Traffic at Headquarters, Military Traffic Management and Terminal Service. He replaces **Capt. Francis Grubb, USN,** who has retired.

DEPARTMENT OF THE ARMY

Maj. Gen. Walter E. Lotz Jr., has been named the new Commanding General of the Strategic Communications Command succeeding **Maj. Gen. Richard J. Meyer** who has retired.

Brig. Gen. Wallace L. Clement is the new Dir. of Doctrine at the Army Combat Developments Command, Fort Belvoir, Va. He succeeds **Brig. Gen. Roy L. Atteberry.**

The Army Combat Developments Command Experimentation Command, Fort Ord, Calif., has a new commanding general. He is **Brig. Gen. Frederick C. Roecker Jr.**

Col. Vincent H. Ellis is the new Dep. Commander, Army Tank Automotive Command, Warren, Mich.

DEPARTMENT OF THE NAVY

Charles A. Bowsher has been sworn in as Asst. Secretary of the Navy for Financial Management. He was nominated for the position when **Charles F. Baird** vacated it to become Under Secretary of the Navy.

Dr. James H. Schulman has been named Associate Dir. of Research for Materials at the Naval Research Laboratory, Washington, D.C.

Dr. Boyd E. Olson has been named Dep. Scientific and Technical Dir. of the Naval Oceanographic Office, Washington, D.C.

RAdm. Marshall W. White is the new Commander of the Navy's Pacific Missile Range, Point Mugu, Calif.

Capt. John C. Doherty has been assigned as Asst. Commander, Naval Ordnance Laboratory, White Oak Md.

Capt. John R. Lindsay has been reassigned to duty as Dep. Dir., Deep Submergence Systems Project, Naval Material Command.

DEPARTMENT OF THE AIR FORCE

The following named officers have been nominated for appointment to the temporary general officer grades indicated:

Major General;

Brig. Gen. John L. Martin Jr., Dir., Special Projects, Office of the Secretary of the Air Force; **Brig. Gen. Lee V. Gossick,** F-111 Systems Program Dir., Aeronautical Systems Div., Air Force Systems Command; **Brig. Gen. Daniel E. Riley,** Commander, Air Force Contract Management Div., Air Force Systems Command; **Brig. Gen. Henry B. Kucheman Jr.,** Vice Commander, Aeronautical Systems Div., Air Force Systems Command; **Brig. Gen. Frederick E. Morris Jr.,** Commander, Advanced Logistics Systems Center, Air Force Logistics Command; **Brig. Gen. James F. Hackler Jr.,** Dep. Dir. of Information, Office of the Secretary of the Air Force.

Brigadier General:

Col John French, Executive to Vice Chief of Staff, USAF; **Col. Maurice A. Cristadoro,** Commander, Systems Engineering Group, Air Force Systems Command; **Col. Spencer S. Hunn,** Vice Commander, Electronic Systems Div., Air Force Systems Command; **Col. Fred W. Vetter Jr.,** Military Asst. to the Secretary of Air Force; **Col. William G. King Jr.,** Asst. Dep. Chief of Staff (Operations), Air Force Systems Command; **Col. Roger K. Rhodarmer,** Dep. Asst. for Reconnaissance, Dep. Chief of Staff (Research & Development), Hq., USAF; **Col. Harvey W Eddy,** Dep. Asst. for Research & Development Programming, Dep. Chief of Staff (Research & Development), Hq., USAF; **Col. David L. Carter,** Dep. Dir. for Research & Development, Office, Space Systems, Office of the Secretary of the Air Force; **Col. James A. Bailey,** Chief, Airborne Radio Navigation Inventory Management Div., Warner-Robins Air Materiel Area, Air Force Logistics Command; **Col. Alfred L. Esposito,** Chief, F-111 Programming, Dep. Chief of Staff (Systems & Logistics), Hq., USAF; **Col. Donald H. Ross,** Chief, Tactical Airlift Div., Dep. Chief of Staff (Programs & Resources), Hq., USAF; **Col. Abraham J. Dreiseszun,** Dir., Procurement & Production, Air Force Logistics Command; **Col. Warner E. Newby,** Dep. Dir., Production & Programming, Dep. Chief of Staff (Systems & Logistics), Hq., USAF.

Brig. Gen. Leo A. Kiley has taken command of the Air Force's Office of Aerospace Research, Arlington, Va. He Replaces **Maj. Gen. Ernest A. Pinson** who is now Commandant of the Air Force Institute of Technology.

Col. Eugene Finke has been assigned as Dir., Research Programs, Office of Aerospace Research.

The Government's Role in Minding Its Contractor's Business

Brigadier General Daniel E. Riley, USAF

One persistent problem in the defense industry/government relationship is the extent to which the Government does, should, or should not "mind the business" of its contractors.

It is a problem with which the Air Force Contract Management Division (AFCMD) of the Air Force Systems Command is actively concerned. The division has plant representatives in 22 major aerospace companies across the country and is currently managing about 6,000 prime contracts with a total face value of approximately $42 billion. Among the systems for which AFCMD administers contracts are:

- Aircraft—the C–130, C–141, C–5A, T–38 and the F–111.
- Ballistic missiles—the Air Force Minuteman and Titan II, SCRAM (Supersonic Combustion Ramjet), the Navy Polaris and Poseidon.
- Space programs — the MOL (Manned Orbiting Laboratory), and the National Aeronautics and Space Administration's Saturn space launch vehicle.
- Advanced research projects —the Air Force PRIME (Precision Recovery Including Maneuvering Entry) SV–5D lifting body vehicle.

To whatever extent the Government is minding the business of the contractors involved in these programs, it is doing so largely through Air Force plant representatives. Plant representative office staffs range from 50 to 200 people. They provide on-site engineering service, quality assurance, and technical cognizance over performance, schedules and cost. They also interpret DOD contract policies and objectives, and provide service as required by the contractor and the Air Force system program director.

AFCMD also has five detachments at Air Force test sites, where final testing is done, to administer the contractual provisions of the test program. Personnel at these sites provide on-the-spot monitoring of contractor test operations, check hardware performance, and insure that the contractor fulfills his flight-test responsibilities.

The ideal degree of active government participation in a contractor's system management is a delicate balance between maximum protection of the taxpayer's interests, and minimum distortion of the free enterprise system. It would achieve what might be called "responsive visibility," assuring that the Government gets sufficient information and control to see program progress and problems clearly at any given moment, and to step in effectively with its own management resources only where and when it becomes apparent that the contractor's effort is inadequate and headed for trouble.

Brig. Gen. Daniel E. Riley, USAF, is the commander of the Air Force Contract Management Division of the Air Force Systems Command, at Los Angeles Air Force Station, Calif. Previously he was vice commander of AFSC's Electronic Systems Division. During his career he has held various positions in procurement management. He is a graduate of the Industrial College of the Armed Forces and holds a masters degree in business administration from the University of Michigan.

Such a balance is not easy to achieve, though there are indications that we are making some noteworthy progress toward it today.

Historically, the degree of government active engagement in the internal management of defense industry has fluctuated with changes in the nature of defense material, in the urgency of hardware needs, and in government philosophies and techniques of procurement.

The trend during the 1950s and very early 1960s, for a number of reasons, was toward increasingly deep government engagement. At that time revolutionary and extremely complex ballistic weapon and space systems were being developed under the pressures of urgent priorities. Both Government and industry were pioneering wholly unfamiliar territory, in high-risk systems of such complexity that development costs were too great to be borne by private industry. There was, of necessity, a heavy reliance on sole source procurement, since no truly competitive capabilities had yet been developed within industry for these types of systems. In 1961, for instance, 85 percent of the Air Force's awards were non-competitive; 46 percent were cost-plus-fixed-fee.

The amount of autonomy given to industry, as well as industry's profit, is related directly to the degree of risk which industry assumes, and to the element of competition in the procurement atmosphere. With both at a low ebb, government intervention in contractor managment tended to increase.

Another aspect of early space-age procurement, that had a tendency to stunt development and improvement of industry's internal systems management capabilities, was the government practice of "piecemeal" procurement. Because it was difficult, if

not impossible, to estimate in advance the exact total performance and cost of the systems, it became the normal practice to award only the development work at the outset of a program. Unless the contractor was a spectacular failure in this phase of the program, he was practically assured of the follow-on procurement, with no commitment concerning ability to control costs, assure performance, or meet schedules. The alternative, selection of a new contractor, meant duplication of the greatest part of the original development costs. The Government tended to over-compensate for the known, but unavoidable shortcoming of this procurement method by assuming an unusually active role in monitoring industry's internal management.

Contributing still further to the tendency toward over-control by the Government was the mid-century revolution in the tools and techniques of data processing and storage. Helpful as the new computer capabilities were, they tended to encourage the proliferation of new reporting requirements. The Government became involved in evermore detailed surveillance of industry management.

By the early 1960s, however, the procurement atmosphere, particularly in the Air Force, was beginning to undergo marked changes. After almost a decade of highly concentrated space-age experience, an invaluable working knowledge of the realities of space-age technology has been acquired. Greater attention was gradually concentrated on integrated defense planning and management, more effective use of resources, and improvement of the acquisition process and the general climate of the government/industry working partnership.

One angle of approach was the drastic reduction of cost-plus-fixed-fee contracts. A substitute was the negotiated fixed-fee contract, based on weighted guidelines which took into consideration the element of risk for the contractor and the contractor resources, capital and skills required.

The usefulness of the fixed-fee contract has been further enhanced by the addition of incentive arrangements which reward the contractor for improving upon specified hardware performance, cost, or delivery schedule, and penalize him for failure to meet performance, cost, or schedule objectives originally established. This prospect of higher profits and threat of loss constitutes a most effective incentive to industry to put forth a maximum effort in good management.

The successful shift from cost-plus to fixed-fee with incentive contracting is amply attested by the record. In FY 1962, 46.9 percent of all Air Force contracts were cost-plus-fixed-fee. By FY 1967, the percentage had dropped to 5.1.

Improved source selection in awarding contracts to industry is also proving to be a promising approach to a healthier balance in the government/industry management relationship. An Armed Services Procurement Regulation revision of June 1, 1965, sets forth requirements for an exhaustive pre-contract investigation of contract capabilities, as a measure to reduce the necessity for remedial government intervention at a later date. In addition, the Contractor Performance Evaluation Report, inaugurated in 1963, provides a continuing semi-annual evaluation of performance on certain contracts. This report provides a long-term incentive to contractors by creating, within the Government, a "memory" of contractor performance and a means for considering this record in future source selections and negotiations.

For the last several years, also, both industry and Government have been making concentrated efforts to clean up the tropical undergrowth of management systems and reporting requirements that has resulted from the data management revolution. The Systems Management Analysis Group of the Aerospace Industries Association and the Office of the Secretary of Defense combined their findings in 1966. The result was DOD Directive 7000.1, establishing one central control point for all management systems within the Defense Department. This responsible office, the Directorate of Management Systems Control in the Office of the Assistant Secretary of Defense (Comptroller), is now working on improving "responsive visibility" by some judicious thinning of the management systems thicket.

One final development, also making a substantial contribution to an improved management balance, is the trend toward total package and life cycle procurement. One of the basic principles of total package procurement is a high degree of disengagement of control over contractors,

An artist's concept of the Air Force PRIME (Precision Recovery Including Maneuvering Entry) SV-5D vehicle.

after a long-term program has been established under competitive conditions. Total package procurement is the antithesis of the piecemeal approach. It is procurement through one-time open competition of a maximum number of elements of a system, throughout engineering, development, production, maintenance, etc.

Though it does have certain inherent limitations and disadvantages, total package procurement puts the competitive muscle tone back into government procurement. It integrates and simplifies the procurement process as a whole. It gets the contractor back into business on his own, permitting maximum government disengagement from his internal management.

All of these trend makers of recent years—the strengthening of the competitive element in contracting, improved source selection, tightening control of systems management and reporting requirements and techniques, the introduction of new procurement methods such as the total package concept—give promise of progressively improving government/industry working relationships. The Government is as eager as industry to attain the closest thing to an uncomplicated "we buy—you sell" relationship that our public trust will permit. Government procurement by its very nature can never be a simple process. However, prospects are certainly looking up for achieving a better balance of the management skills which both Government and industry possess. In the process, the Government can expect to get better value for the taxpayer's dollar, and industry can look forward to profits and autonomy which more nearly reflect the effectiveness of industrial management as proven by performance.

Note

The item concerning the establishment of the DOD-Industry Assets Managements Systems Advisory Committee, carried on page 35 of the February 1968 issue of the *Defense Industry Bulletin*, included a list of current members. The name of one member, A. J. Rothstein, Electronic Industries Association, was inadvertently omitted in the original release.

Defense Procurement Conference Program Scheduled for Second Half of FY 1968

The fifth of the current series of Defense Department procurement conferences will be held at El Paso, Tex., April 11.

A total of 17 conferences have been scheduled for the second half of FY 1968 as part of DOD's continuing effort to develop additional competitive sources, large and small, to meet defense requirements.

Procurement conferences are designed to provide a single location for businessmen and potential contractors to become acquainted with the Federal procurement and contract process; to have practical individual discussions with specialists on business opportunities in the Army, Navy, Air Force and Defense Supply Agency; and to be counseled on the activities of the Defense Contract Administration Services, the Defense Documentation Center, the Defense Specifications Center, and other defense organizations concerned with prime contracting and subcontracting.

An item of special interest at the conferences will be the $30 to $50 million in current Invitations for Bid (IFBs) and Requests for Proposals (RFPs), including a number of "small purchase" ($2,500 and under) packages which will be on hand with Army, Navy, Air Force, and Defense Supply Agency counselors.

A new approach during this second half of FY 1968 will be tried at the procurement conference to be held in the Tri-Cities of Richland, Pasco, and Kennewick, Wash., which will be research and development oriented. This procurement functional area will be highlighted in the symposiums held during the conference on preparation of unsolicited proposals, the Defense Documentation Center services, etc.

Major defense prime contractors play an active part in these conferences. A number of DOD's prime contractors, usually from the area contiguous to the conference site, will be on hand to discuss subcontract opportunities.

The Defense Department will be joined in all procurement conferences by other Federal agencies, including the Department of Commerce, the Small Business Administration, the National Aeronautics and Space Administration, and General Services Administration. In addition, the Post Office Department, the Atomic Energy Commission, Veterans Administration, Department of Interior, Department of Agriculture, and other agencies will participate in specific conferences which relate to their activities.

Following is a listing of the dates, locations and contacts of procurement conferences scheduled for the remainder of the fiscal year:

April 11	El Paso, Tex. Milton E. Hopper Phone (915) 533–1421
April 17	Farmington, N.M. Jerry Brown Phone (202) 225–2365
April 22–23	Richland, Wash. Tom C. Hynes Jr. Phone (509) 946–5162
April 23	Sioux Falls, S.D. Gary Kizzier Phone (605) CA 4–5911, Ext. 307
April 30–May 3	Orlando, Fla. Russell H. Nahm Phone (305) 424–9531
Week of May 7	Brooklyn, N.Y. John A. Davis Phone (212) 625–5778
May 10	Queens, N.Y. Michael Goldenthal Phone (212) RA 8–3060
May 17	Columbus, Ga. Lennie Davis Phone (404) 324–3091
May 24	Bethpage, N.Y. Bertram F. Sternfield Phone (516) LR 5–3201
June 4	Anaheim, Calif. James H. Hannaham Phone (202) 225–2965
June 11	Nashville, Tenn. Contact to be named later. Interim contact—Morris Questal, Navy Dept., Washington, D.C. Phone (202) OX 6–2960
June 25–26	Harrisburg, Pa. Dean W. Moore Phone (717) 233–5668

BIBLIOGRAPHY

Defense Procurement Circulars

Distribution of Defense Procurement Circulars is made automatically by the U. S. Government Printing Office to subscribers of the Armed Services Procurement Regulation (ASPR).

Defense Procurement Circular No. 58, Jan. 31, 1968. (1) Progress Payments. (2) Assignment of Contracts for Administration. (3) Disclosure of Audit Results to Contractors. (4) Equal Employment Opportunity—Assurance on Nonsegregated Facilities. (5) Cost-Sharing Policies. (6) Service Contract Act. (7) Procurement Management Reporting System. (8) Clauses for Fixed-Price Construction Contracts.

Defense Procurement Circular No. 59, Feb. 14, 1968. (1) Material Inspection and Receiving (MIRR) (DD Form 250 Series).

Research Reports

Authorized DOD contractors and grantees may obtain these documents without charge from
Defense Documentation Center
Cameron Station
Alexandria, Va. 22314

Others may purchase these documents at a price of $3 each (microfiche 65¢), unless otherwise indicated, from:
Clearinghouse for Federal and Scientific Information
Department of Commerce
Springfield, Va. 22151

Conceptual Study of Electrical Power Transmission Systems to Deep Ocean Installations. General Dynamics Corp., Groton, Conn., for the Navy, Aug. 1967, 451 p. Order No. AD–662 037.

Sorption of Gaseous Hydrocarbons at Fuel Cell Catalysts of the Platinum Metal Group. Battelle Institute, Columbus, Ohio, for the Army, Sept. 1967, 48 p. Order No. AD–661 381.

Development of Improved Zinc Batteries for High Temperature Storage. Marathon Battery Co., Wausau, Wis., for the Army, Nov. 1967, 33 p. Order No. AD–661 306.

Study of Thermoelectric and Thermionic Power Conversion. Tyco Labs, Inc., Waltham, Mass., for the Navy, Oct. 1967, 235 p. Order No. AD–661 455

Stream Powered Generator. Philco-Ford Corp., Newport Beach, Calif., for the Navy, July 1967, 64 p. Order No. AD–660 009.

Guide to Test Methods for Plastics and Related Materials. Picatinny Arsenal, Dover, N.J., Aug. 1967, 84 p. Order No. AD–662 049.

Wind Tunnel Simulation of Head-on Bow Wave—Blast Wave Interactions. Naval Ordnance Lab., White Oak, Md., Aug. 1967, 129 p. Order No. AD–661 790.

An Analytical Cost Comparison of Computer Operating Systems. Systems Development Corp., Santa Monica, Calif., for the Air Force, June 1967, 213 p. Order No. AD–661 983.

Density/Conductivity Anomaly for Non-Constancy of Composition in Seawater. Naval Underwater Weapons Research & Engineering Station, Newport, R.I., Oct. 1967, 21 p. Order No. AD–661 234.

Reference Design Study of Mist-Jet Propulsion Systems in Captured-Air-Bubble Ships. Naval Ship Research & Development Center, Washington, D.C., Nov. 1967, 72 p. Order No. AD–661 801.

Conceptual Study of Electrical Power Transmission Systems to Deep Ocean Installations. General Dynamics Corp., Groton, Conn., for the Navy, Aug. 1967, 451 p. Order No. AD–662 037.

Model Tests of Stepped Planning Boat With an Adjustable Stern Stabilizer. Naval Ship Research & Development Center, Washington, D.C., May 1967, 62 p. Order No. AD–661 792.

Military Transfer of Technology. Howard University, Washington, D.C., for the Air Force, March 1967, 276 p. Order No. AD–660 537.

Direct and Inverse Problems for Integral Equations Via Initial-Value Methods. Rand Corp., Santa Monica, Calif., for the Air Force, Oct. 1967, 40 p. Order No. AD–661 550.

GOVERNMENT PRINTING OFFICE PUBLICATIONS

These publications may be purchased at the prices indicated from:
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

United States Activities in Spacecraft Oceanography. Presents some examples of opportunities for a broad extension of ocean observation techniques. Oct. 1, 1967. 44 p. il. 65c.

Navy Systems Design Guidelines Manual, Electronic Packaging. Provides a compendium of complementary electronic packaging approaches developed under the direction of Navy facilities for the organization and construction of electronic systems. 1967. 277 p. il. D201.6/12: E12. $3.

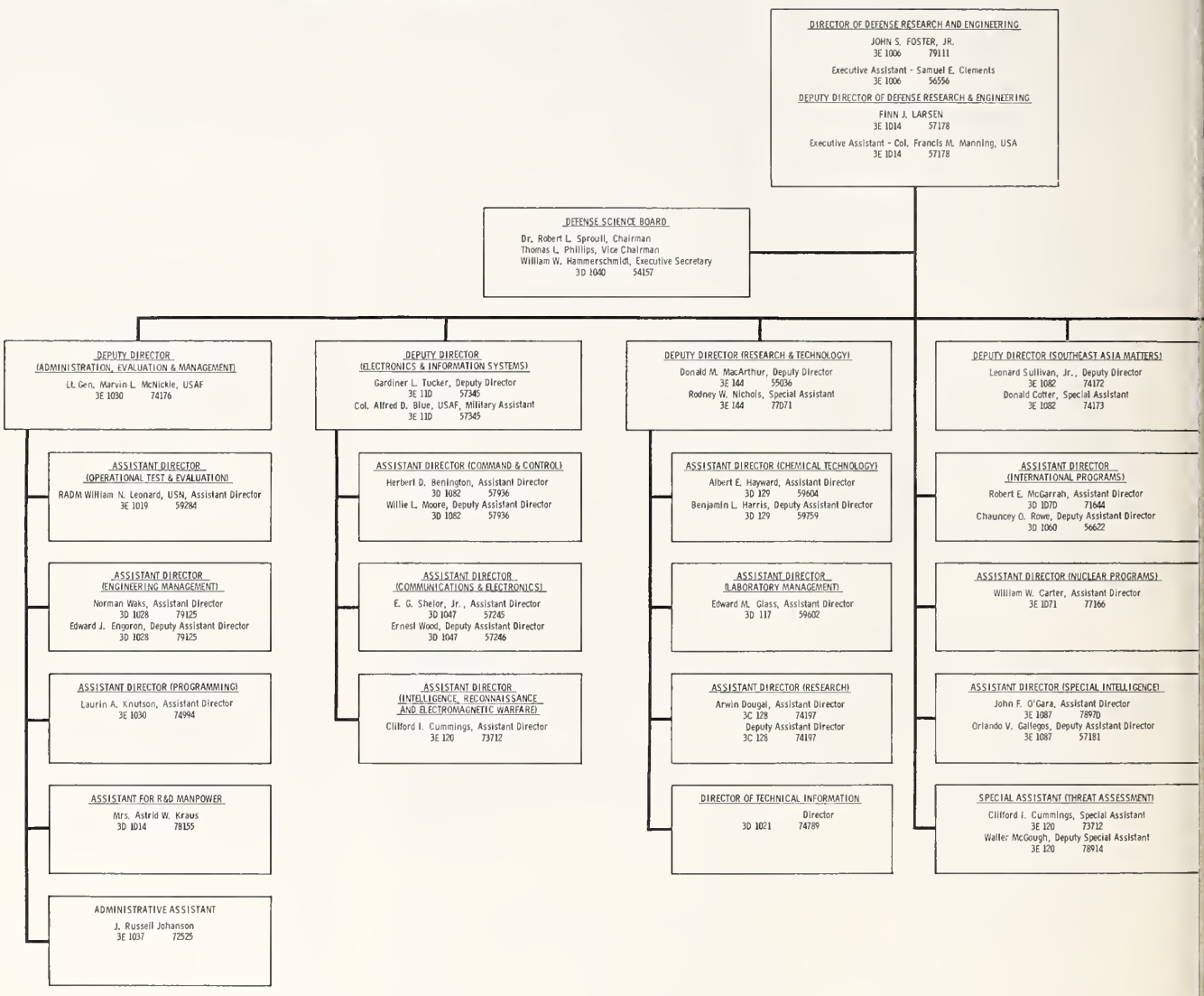
Department of the Navy RDT&E Management Guide. Provides an overview of organization for research, development, test and evaluation (RDT&E) and procedures for planning programming, budgeting, appraisal, and procurement. Rev. 1967. 308 p. il. D201.6/12:M31/967. $1.75.

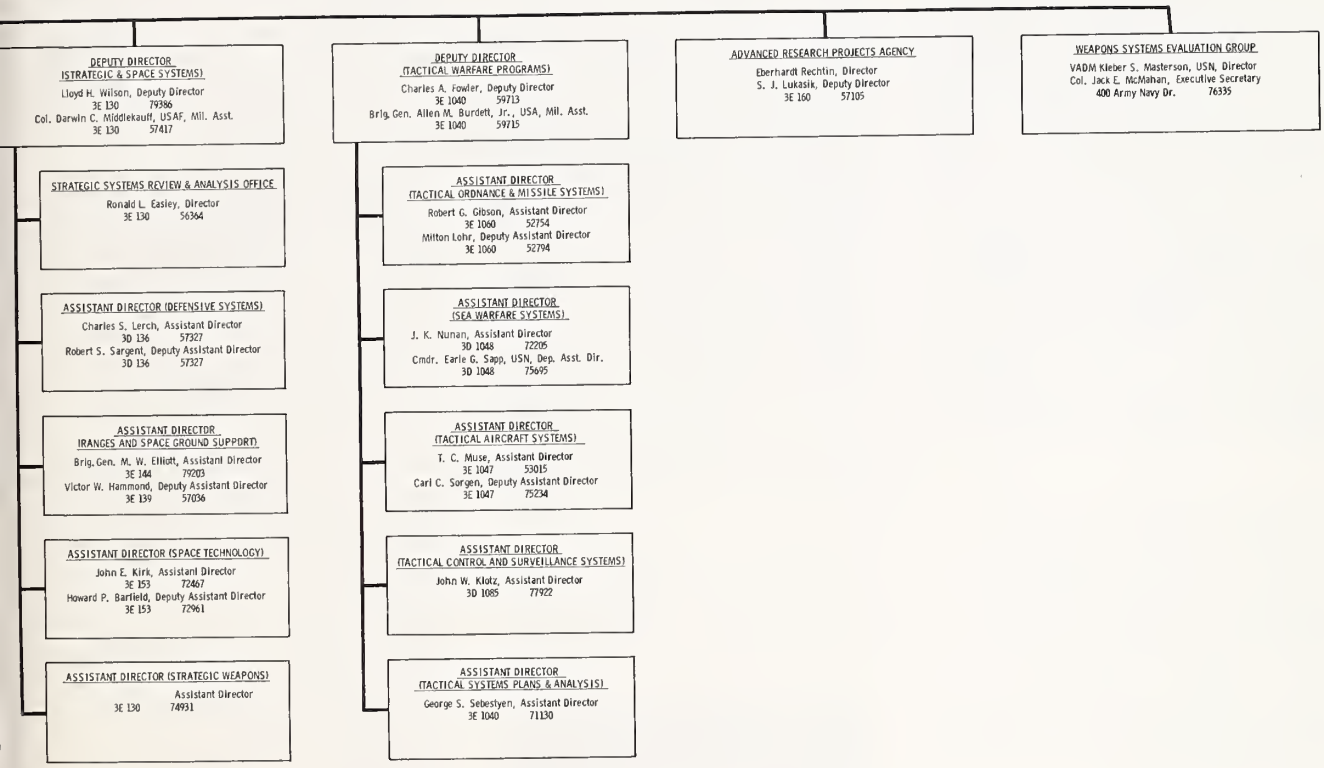
Oceanography '66, Annual Report Naval Oceanographic Office. Provides a brief summary of the programs and efforts carried on at the U.S. Naval Oceanographic Office. 1967. 62 p. il. D203.1:966 40¢

Effective Use of the Sea, Report of the Panel On Oceanography of the President's Science Advisory Committee. Presents findings and conclusions of the Panel on Oceanography. 1966. 144 p. il. Pr 35.8:Sci 2/Se 1. 60¢

Armed Services Procurement Regulation, Supplement No. 3, Property Administration, Aug. 1, 1967. Prescribes uniform procedures and techniques to meet management data requirements of the Government, and to assure performance of property control to protect the interests of the Government at a minmum cost through a unform DOD property administration program. 1967. 38 p. D1.13/2–2:3. 25¢.

OFFICE OF THE DIRECTOR OF DEFENSE RESEARCH AND ENGINEERING




DEPUTY DIRECTOR
(STRATEGIC & SPACE SYSTEMS)
Lloyd H. Wilson, Deputy Director
3E 130 79386
Col. Darwin C. Middlekauff, USAF, Mil. Asst.
3E 130 57417
STRATEGIC SYSTEMS REVIEW & ANALYSIS OFFICE
Ronald L. Easley, Director
3E 130 56364
ASSISTANT DIRECTOR (DEFENSIVE SYSTEMS)
Charles S. Lerch, Assistant Director
3D 136 57327
Robert S. Sargent, Deputy Assistant Director
3D 136 57327
ASSISTANT DIRECTOR
(RANGES AND SPACE GROUND SUPPORT)
Brig. Gen. M. W. Elliott, Assistant Director
3E 144 79203
Victor W. Hammond, Deputy Assistant Director
3E 139 57036
ASSISTANT DIRECTOR (SPACE TECHNOLOGY)
John E. Kirk, Assistant Director
3E 153 72467
Howard P. Barfield, Deputy Assistant Director
3E 153 72961
ASSISTANT DIRECTOR (STRATEGIC WEAPONS)
Assistant Director
3E 130 74931
DEPUTY DIRECTOR
(TACTICAL WARFARE PROGRAMS)
Charles A. Fowler, Deputy Director
3E 1040 59713
Brig. Gen. Allen M. Burdett, Jr., USA, Mil. Asst.
3E 1040 59715
ASSISTANT DIRECTOR
(TACTICAL ORDNANCE & MISSILE SYSTEMS)
Robert G. Gibson, Assistant Director
3E 1060 52754
Milton Lohr, Deputy Assistant Director
3E 1060 52794
ASSISTANT DIRECTOR
(SEA WARFARE SYSTEMS)
J. K. Nunan, Assistant Director
3D 1048 72205
Cmdr. Earle G. Sapp, USN, Dep. Asst. Dir.
3D 1048 75695
ASSISTANT DIRECTOR
(TACTICAL AIRCRAFT SYSTEMS)
T. C. Muse, Assistant Director
3E 1047 53015
Carl C. Sorgen, Deputy Assistant Director
3E 1047 75234
ASSISTANT DIRECTOR
(TACTICAL CONTROL AND SURVEILLANCE SYSTEMS)
John W. Klotz, Assistant Director
3D 1085 77922
ASSISTANT DIRECTOR
(TACTICAL SYSTEMS PLANS & ANALYSIS)
George S. Sebestyen, Assistant Director
3E 1040 71130
ADVANCED RESEARCH PROJECTS AGENCY
Eberhardt Rechtin, Director
S. J. Lukasik, Deputy Director
3E 160 57105
WEAPONS SYSTEMS EVALUATION GROUP
VADM Kleber S. Masterson, USN, Director
Col. Jack E. McMahan, Executive Secretary
400 Army Navy Dr. 76335

MEETINGS AND SYMPOSIA

APRIL

Photochemistry and Radiation Chemistry Symposium, April 22-24, at Natick, Mass. Co-Sponsors: Army Natick Laboratories and the National Academy of Sciences-National Research Council Advisory Board. Contact: Dr. E. Hayon, Head, Physical Chemistry Laboratory, U.S. Army Natick Laboratories, Natick, Mass. 01760, Phone (617) 653-1000, Ext. 137.

Frequency Control Symposium, April 22-24, at the Shelburne Hotel, Atlantic City, N.J. Sponsor: Electronic Components Laboratory, Army Electronics Command, Fort Monmouth, N.J. Contact: Director, Electronics Components Laboratory, Army Electronics Command, Attention: AMS EL-KL-ST (Mr. M. G. Timm), Fort Monmouth, N.J. 07703, Phone (201) 535-2826 or 1728.

Advance Planning Briefing on Electronic Components, April 25-26, at Fort Monmouth, N.J. Co-Sponsors: National Security Industrial Association and the Army Electronics Command, Fort Monmouth, N.J. Contact: Dr. Eduard A. Gerber, Electronics Components Laboratory, Army Electronics Command, Fort Monmouth, N.J. 07703.

MAY

Vacuum Ultraviolet Radiation Physics–Interaction with Solids Conference, May 1-3, at Gatlinburg, Tenn. Co-sponsors: Army Research Office-Durham, and the Office of Naval Research, Contact: Dr. Robert Mace, Director, Physics Div., Army Research Office-Durham, Box CM, Duke Station, Durham, N.C. 27706, Phone (919) 286-2285.

Interagency Data Exchange Program (IDEP) Sixth Annual Workshop, May 1-3, at the Ambassador Hotel, Los Angeles, Calif. Sponsors: The Army member of the IDEP Policy Board, OCRD, Air Force, Navy, NASA and the North American Rockwell Corp. Contact: Mr. Bobbie Barnet, Army IDEP Officer, MICON, Redstone Arsenal, Ala. 35809, Phone (205) 876-0851.

Fifth National Colloquium on Information Retrieval, May 3-4, at the University of Pennsylvania, Philadelphia, Pa. Sponsors: Moore School of Electrical Engineering, University of Pennsylvania, Institute of Electrical and Electronic Engineers, Special Interest Group on Information Retrieval, American Documentation Institute Association for Computing Machinery and Frankford Arsenal. Contact: George Schecter, Chief, Objectives Analysis Office, Frankford Arsenal, Philadelphia, Pa. 19137, Phone (215) JE 5-2900, Ext. 3219.

Enhancing the Effectiveness of Fleet Systems—A Problem of Teamwork, Fourth Naval Material Command Systems Performance Effectiveness Conference, May 8-9, at the West Auditorium, Department of State, Washington, D.C. Sponsor: Naval Material Command. Contact: Mr. G. W. Neumann, Executive Secretary, SPE Steering Committee, Naval Ship Systems Command, Code 03511, Washington, D.C. 20360, Phone (202) OX 6-3097.

Universal Aspects of Atmospheric Electricity Conference, May 12-18, in Tokyo, Japan. Sponsors: Air Force Cambridge Research Laboratories, Office of Naval Research and the National Science Foundation. Contact: Capt. J. H. Shock (CRTE), Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Mass. 01730, Phone (617) 274-6100, Ext. 3636.

Second International Meeting on Silicon Carbide, May 14-16, at Pennsylvania State University, University Park, Pa. Sponsors: Air Force Cambridge Research Laboratories, Pennsylvania State University and the Corborundum Co. Contact: Mr. C. E. Ryan, Air Force Cambridge Research Laboratories (CRWF), L. G. Hanscom Field, Mass. 01730, Phone (617) 274-6100, Ext. 2234.

1968 International Conference on Quantum Electronics, May 14-17, at the Everglades Hotel, Miami, Fla. Sponsor: Office of Aerospace Research. Contact: Lt. Col. Robert Kalisch, Air Force Office of Scientific Research, 1400 Wilson Blvd., Arlington, Va. 22209, Phone (202) OX 4-5518.

Aerodynamic Noise Symposium, May 20-21, at Toronto, Canada. Sponsor: Office of Aerospace Research. Contact: Maj. D. L. Calvert, Air Force Office of Scientific Research (SREM), 1400 Wilson Blvd., Arlington, Va. 22209, Phone (202), OX 4-5568.

Functional Analysis Conference, May 20-24, at the University of Chicago. Sponsor: Office of Aerospace Research. Contact: Dr. R. G. Pohrer, Air Force Office of Scientific Research (SRMM), 1400 Wilson Blvd., Arlington, Va. 22209, Phone (202) OX 4-5264.

JUNE

Fourth Conference on **Atmosphere Contamination in Confined Spaces**, June 4-6, at Dayton, Ohio. Sponsor: Aerospace Medical Research Laboratory. Contact: Dr. Anthony Thomas, 6570 Aerospace Medical Research Laboratory (MRTB), Wright-Patterson AFB, Ohio 45433, Phone (513) 255-5740.

Society of **Photographic Scientists and Engineers** Annual Conference, June 10-14, at Boston, Mass. Co-sponsors: Rome Air Development Center and the Society of Photographic Scientists and Engineers. Contact: Mr. Pohorence (EMIRC), Rome Air Development Center, Griffiss AFB, N.Y. 13440, Phone (503) 330-7210.

Atomic Physics Conference, June 12-15, at New York University. Sponsors: Army Research Office-Durham, Atomic Energy Commission, National Science Foundation, Air Force Office of Scientific Research, Office of Naval Research, New York University, Brookhaven National Laboratory and the International Union of Pure and Applied Physics. Contact: Dr. Robert Mace, Director, Physics Div., U.S. Army Research Office-Durham, Box CM, Duke Station, Durham, N.C. 27706, Phone (919) 286-2285.

Multivariate Analysis Symposium, June 17-22, at Dayton, Ohio. Co-Sponsors: Aerospace Research Laboratories and Wright State University. Contact: Dr. P. R. Krishnaiah (ARM), Aerospace Research Laboratories, Wright-Patterson AFB, Ohio 45433, Phone (513) 255-3761.

Bioastronautics and the Exploration of Space Symposium, June 23-27, at San Antonio, Tex. Sponsor: Aerospace Medical Div., Air Force Systems Command. Contact: Dr. Mitchell (AMRS), Aerospace Medical Div., Brooks AFB, Tex. 78235, Phone (512) LE 2-8811, Ext. 3211.

FROM THE SPEAKERS ROSTRUM

Excerpts from statement by Dr. John S. Foster, Jr., Dir., Defense Research and Engineering, on the FY 1969 Defense Research, Development, Test and Evaluation Program before the Senate Committee on Armed Services, Feb. 15, 1968.

General Highlights

. . . I will begin today by outlining highlights of the overall research and development (R&D) effort: changes in threats; . . . plans for significant activities beginning or expanding in FY 1969; . . . and finally, our proposed budget. . . .

Changes in Threats

To manage defense R&D we must examine any shifts in the actual and potential threats to national security. The purpose of each R&D effort must be measured explicitly in terms of improvements to our current capabilities to meet known or possible threats.

I believe I can explain a central component of our R&D management philosophy through a fairly straightforward argument. First, we recognize that the Soviet Union—and China, of course—are still characterized by secrecy. A veil masks many details of their defense planning. This produces uncertainty in our estimates of their current and likely future forces, and even more uncertainty about the pace and goals of their advanced research. This demands that we carry out an aggressive R&D program to guard against surprises.

Because we cannot be sure about the types and numbers of their planned deployments, we must develop, and in some cases even deploy, systems to assure that we will possess an adequate capability. This margin of strategic safety—some choose to call it a margin of superiority—has been substantial. We plan to continue this strategy. We openly explain the strategy in the hope that public disclosure of our general capabilities, our intent, and our R&D objectives, will deter attack and allow us to move toward a less tense peace.

A significant conclusion we draw from this argument is that our research and technology base—the research, exploratory development, and advanced development programs—must be protected carefully and must not be permitted to erode. There is no "technological plateau" now, nor is one about to be created. But, as I will discuss in detail later, we are convinced that our research and exploratory development requires increased support during the next few years to ensure many options—a margin of safety—against any technological challenge. . . .

* * * *

Some Major R&D Plans for FY 1969

Each year brings a group of R&D decisions that can influence our defense capability for many years. I want to mention a few of these now.

After the decision to deploy Sentinel [anti-ballistic missile (ABM) system], immediate steps were taken to reorganize our activity to meet two main R&D goals. First, we will support the initial deployment (the Missile Site Radar and Perimeter Acquisition Radar and the interceptors) and strengthen the related Army efforts. Second, we will continue an aggressive R&D program necessary to avoid obsolescence and to upgrade the system if and when required in the future. To help meet the Army's needs for back-up effort, I plan to transfer to the Army some of the Advanced Research Projects Agency (ARPA) scientists and part of the money in the ARPA ballistic missile defense project. The remaining group in ARPA will explore possibly feasible, novel techniques which could drastically change the offense-defense balance.

Dr. John S. Foster Jr.

Assuming continued success, the recent experiments in overland radar technology permit us to consider a development program that may revamp our current strategic air defenses, which are now vulnerable to low altitude attack. The planned new system would have much increased capability against all altitude attacks, and could offer annual maintenance savings of as much as $600 million compared with current defenses. This system is expected to include an airborne command and control system (AWACS) and over-the-horizon radars, based upon a much upgraded version of the F–106 interceptor with a new air-to-air-missile.

Studies indicate that the deployment of missiles in "superhard" silos would provide significantly improved survivability against potential improvements in Soviet missile accuracy. Air Force and Defense Atomic Support Agency (DASA) studies and tests confirmed that the technology to build these silos was available. We are initiating engineering development of a prototype silo (hardened) that can hold Minuteman III or a larger missile. . . .

We are also augmenting our effort in the strategic bomber penetration field.

To assure our capability for air superiority against improved Soviet aircraft in any environment during the 1975-85 period, we should replace our F–4s, the first-line Air Force and Navy fighters. The advancing technology in engines and airframes, along with more flexible and reliable avionics and weapons, make possible a substantial improvement in fighter capability. A competitive program to demonstrate the total avionics-weapons capability before deciding on a particular design should give us the advantages of the "fly-before-buy" prototype approach. In this way, we hope to achieve a better system with greater assurance at lower program cost.

In the Manned Orbiting Laboratory program, we plan to carry out the first manned launch in the early 1970s. . . .

. . . One of the increasingly significant threats in South Vietnam, for example, is mortar attacks. We have an urgent development effort on experimental countermortar radars. . . .

Some of the R&D areas to be emphasized during FY1969 in supporting the war in Vietnam are: improved sensors, reconnaissance systems, local communications, perimeter defense systems for a variety of bases and villages, psychological warfare, and advanced intelligence data collection and processing systems. . . .

* * * *

Budget

. . . The FY 1969 request research, development, test and evaluation (RDT&E) is summarized in Figure 1. . . .

Strategic Forces

I want to begin my detailed testimony by discussing the Strategic Forces R&D program. . . . I will review major strategic programs in advanced through operational systems development from the viewpoint of our preparations to maintain our Assured Destruction posture. Finally, I will review our nuclear test and preparedness programs.

* * * *

Strategic Offensive and Defensive Forces

. . . I will discuss first the new threats that are "real" or "expected" in the intelligence sense. . . .

Second, I will discuss possibilities that worry me . . .

Third, I will present the kinds of longer-term potential threats that could be significant if they occurred. . . .

Fourth, I will discuss the evolving threat represented by Communist China and our responses to it.

Finally, I will review the particular threat to our wartime command and control capability and the measures being taken to assure message execution under all circumstance.

• **New Threats—Operational or Near-Operational—and U.S. Preparations.**

Moscow ABM: This is believed to be an area type ballistic missile defense system based around Moscow and may be capable of intercepting missiles directed at most of Western European Russia.

U. S. Preparations: We are developing penetration aids and multiple warheads to decrease the number of missiles necessary to destroy the targets that could be defended by this system, and to hedge against possible future additions to their missile interceptor force.

FOBS: The fractional orbit bombardment system (FOBS) presents two potential threats. First, it could reduce the warning time available to our bomber forces and, second, it could reduce the area coverage of the Sentinel Spartan interceptors.

U. S. Preparations: We are accelerating the development and deployment of the forward scatter Over-the Horizon (OTH) warning system to maintain the necessary warning time for our bombers.

Increased ICBM Forces: The Soviet Union is rapidly deploying ICBMs. When the accuracies and numbers of these missiles are considered to gether, we do not believe these missiles presently pose a serious threat to our total ICBM force as long as our goals for survivability (hardness) are being met.

U. S. Preparations: An extensive review of the in-silo vulnerability of the missile force has been made. A program to upgrade the silo configurations is continuing and further testing procedures are under development. An airborne Launch Control Center (LCC) capability has been developed that can fire the missiles independently of ground LCC survival.

• **Potential Near-Term Threats and U. S. Preparations.**

Possible Accurate ICBMs: Should Soviet missile achieve greater accuracy or be MIRVed, they would become a threat to the land-based missile component of our strategic retaliatory force.

U. S. Preparations: An engineering development program has been started for a prototype hardened silo to maintain present Minuteman survivability against the higher accuracy threat, and large enough to hold a new large payload missile if, in the future, we decide to deploy one. The planned Sentinel defense system can act as an initial defense of the Minuteman silos. We are maintaining a production capability for Sprint missiles to defend Minuteman. The Missile Site Radars (MSR) are well sited for several deployment alternatives. In addition, for the far term, we are initiating design of new components specifically suited for the defense of super-hardened silos against an extremely advanced threat.

Increased Soviet Submarine Activity: The Soviets now operate patrols within missile range of the U.S. shores, and increasing activity indicates a significantly improved Soviet missile submarine operational capability.

U. S. Preparations: Operational measures are being taken in several programs; for example, we are reducing bomber takeoff delay under conditions of increased alert. To augment the warning presently supplied by shore-based radars, research is continuing on "backscatter" OTH radar by which co-located transmitters and receivers can detect aircraft and missiles at greater ranges. Trade-off studies and analyses are

Research, Development, Test & Evaluation (RDT&E) Budget Request for FY 1969

($ Millions)

Research	$ 433
Exploratory Development	951
Advanced Development	1,007
Engineering Development	856
Management and Support	1,251
Operational Systems Development	3,408
Emergency Fund	125
TOTAL	$8,031

Figure 1.

also being made to determine the best characteristics of an OTH system defense against the aircraft and submarine launched missile threat that might emerge in the 1970s.

• **Some Advanced Technology.**

Advanced technology work on penetration techniques is being performed in the Advanced Ballistic Missile Re-entry System (ABRES) program and the ARPA Defender program. The Defender program, for example, supports studies using a number of instrumentation radars at White Sands Missile Range and at Kwajalein. It also supports some exploratory efforts in decoy design and maneuvering reentry vehicle technology, although most of the previous penetration device work done by the Defender Program has been transferred to ABRES.

The Nike-X Development Program also contributes to offensive system evaluation; for example, by providing sophisticated techniques for flight test evaluation.

• **The Threat from Communist China and U. S. Preparations.**

Missile Threat: Communist China has not yet fired an ICBM-range test missile. Last year we anticipated that event might occur as early as the summer of 1967. Now we estimate it will not happen before the summer of this year and could precede an initial operating capability by about three to four years.

U. S. Preparations: The Sentinel program encompasses a straightforward, but difficult, engineering task of completing the development and test of the Perimeter Acquisition Radar (PAR), the Missile Site Radar (MSR), the Spartan and Sprint missiles, and the associated data processing equipment. A development MSR is now being installed on Kwajalein; Spartans are being fabricated for flight tests. The PAR is under intensive design. A very large effort in computer programming remains to be accomplished. The Air Force and Navy will support the Sentinel system tests by launching ICBM targets. The FY 1969 funding requested for the Air Force and Navy target support is $8 million and $5 million, respectively.

In addition to the Sentinel work leading to operational deployment, we also support a substantial program of advanced defense system work in the Nike-X development program. Its primary function is to develop components which could be introduced into Sentinel later. Total FY 1969 funding requested for the Nike-X development program is $165 million.

Another program, the ARPA Defender effort, also does research and exploratory development in ballistic missile defense, including work on early warning, urban terminal defense, missile kill and vulnerability, and air defense Important related ARPA Defender efforts are in the fields of interceptor technology, system studies, and laser technology. We are arranging the transfer of some of the appropriate ARPA activities to the Army Nike-X program now that we have made the Sentinel deployment decision. I will discuss this later. The requested FY 1969 funding for the total Defender program is $103 million, of which some is expected to be transferred to the Army Sentinel Project.

Bomber Threat: The Chinese bomber threat is small and the Soviet bomber threat appears to be decreasing somewhat. Our bomber defense objectives are to deny damage from the Chinese and prevent the Soviets from having an alternative threat cheaper than missiles. However, current air defense systems permit intercept only a few hundred miles from the North American defense perimeter.

U S. Preparations: As I have mentioned, we plan development and installation of an improved area air defense based on over-the-horizon radar and the Airborne Warning and Control System (AWACS), which is to be used also by our tactical forces. During the past year in the Overland Radar Technology program, preliminary tests successfully demonstrated the basic technological improvements which will make AWACS possible. Assuming continued success after a careful review, we will conduct contract definition on AWACS this year. FY 1969 funding is requested for AWACS.

To exploit this new AWACS capability, we must also upgrade our manned interceptors. Studies have shown that an improved F–106—incorporating AWACS, advanced fire control, and air-to-air missile—is superior in performance and far less costly (by almost tenfold) than any other candidate interceptor system over a 10-year period. With this system, we will balance our defense, along with Sentinel, against both ballistic missiles and strategic bombers.

This spring we will review terminal bomber defenses, including an assessment of the relative utility of Hercules/Hawk and SAM–D in both the strategic and tactical roles. Studies have now been completed which define the improvements that could be made to Nike-Hercules to extend its lifetime. For the longer term we continue to pursue the advanced development effort on SAM–D. The past year has seen several significant achievements in this advanced surface-to-air missile effort.

• **The Threat to Strategic Command and Control.**

. . .The existing Defense Satellite Communications System, consisting of 19 satellites and about 30 terminals deployed world-wide, has clearly demonstrated the usefulness of satellite communications techniques in improving strategic command and control. The system has provided sustained communications supporting Southeast Asia and Seventh Fleet operations, as well as support to both Defense and State during the Israel-Arab conflict. In addition, it provides a previously unavailable capability: the transmission of high quality photographs in a matter of hours rather than days.

The FY 1969 funding request is directed to new, advanced terminals and satellites to provide increased system operational capabilities.

We are investigating the desirability of replacing or augmenting the current airborne command post aircraft with larger, longer endurance aircraft of the C–5 or 747 type. If the mission can be substantiated, these new aircraft might provide increased endurance and data processing capabilities.

Total R&D for an advanced airborne command post is estimated at up to $100 million, depending upon the type and number of aircraft approved and the initial operating capability date selected.

A related supporting program is an Airborne Data Automation project which is testing automatic data processing in existing airborne command post operations, and will be operating on a test basis in 1969.

Nuclear Effects and Nuclear Test Detection

These two programs are vitally important to the survivability and effectiveness of our strategic and general purpose forces. The nuclear effects programs determine the vulnerability/survivability of systems with a high degree of confidence. We have been actively engaged in research and development of nuclear effects simulators for laboratory and field use. Where simulation techniques are not satisfactory, we must also use underground nuclear tests to confirm the results of laboratory experiments.

In the nuclear test detection effort, we attempt to learn about the nuclear weapons programs and progess of potential adversaries. This is a major part of the work to estimate the nuclear threats which our systems would be expected to encounter and survive. These activities are a major fraction of the Defense Department contribution to the four Test Ban Treaty Safeguards. Figure 2 shows the programmed safeguards expenditure. . . .

R&D Support of the War in Southeast Asia

Out initial budget for FY 1969 on currently identified R&D projects to support the war in Southeast Asia is about $525 million. I estimate that by the end of the year the program will increase to about $800 million to meet the special needs that probably will arise. . . .

Counter-infiltration

Men and materiel infiltrated into South Vietnam provide critical help to the communist insurgency and the Viet Cong/North Vietnam Army main force activities. The major infiltration is by land. Infiltration by sea is not felt to be significant. . . .

We have two major problems: detecting infiltrating personnel and vehicles along the many roads, trails, rivers and streams deep under jungle canopy; and effectively attacking these targets around the clock, in all weather conditions. . . .

Neutralization of the VC/NVA Main Force Threat

A major mission of United States and allied forces in South Vietnam is searching for and destroying Viet Cong/North Vietnam Army main force military units. . . .

The major problems with search and destroy (S&D) operations are: the low probability of finding the enemy; once found, the inability to stay in contact; and the rapid gaining of fire superiority.

In almost every case where the enemy faces a superior force, they withdraw. Thus our effectiveness in terms of Viet Cong casualties inflicted is low. To improve our efficiency, primary emphasis must be placed on finding and fixing the enemy. Let me give two examples of current projects:

- An interesting innovation has been the Army's use of the "people sniffer" on a helicopter. Detections have been made under combat conditions; where it was possible to investigate, confirmations were made.
- To provide an improved night combat capability, the Army's Southeast Asia Night Operations program supports many efforts designed for field forces ranging from the individual soldier through airborne assault groups.

To minimize our casualties, which generally occur in the initial period of contact, we must rapidly gain firepower superiority. Today we are willing to expend large amounts of ordnance to overwhelm the enemy. Because of an inability to locate the enemy precisely, this is an inefficient operation. As we improve our detection and localization capability, the improved firepower of new armed helicopters and better munitions will help save lives and reduce costs.

Let me now turn to another problem related to combatting the enemy main force threat: defense of our main military and logistic bases and outposts such as the Special Forces camps and temporary bases. . . . We must detect artillery mortars, and rockets (some mobile, some dug in) and then direct a killing fire.

Before leaving the subject of the so-called "in-country" war, let me discuss the problems in establishing our outposts and bases. This is an area that needs more imaginative attention We would like to be able to rapidly emplace a base, either large or small, in areas where the enemy has some control. A good current example is our construction of strong points near the DMZ, to be used for observation and as bases for reconnaissance patrols. We should be able to draw on pre-fabrication technique for bunkers which can withstand mortar and artillery fire and use machinery for rapid emplacement of obstacle systems (barbed wire, minefields, watchtowers). I intend to emphasize these concepts with the Military Departments.

Department of Defense Program Supporting the Four Safeguards Related to the Test Ban Treaty

(TOA, $ Millions)
(Fiscal Years)

Safeguard		1964	1965	1966	1967	1968	1969
1	*Conduct of Underground Testing*						
	RDT&E (DASA)	10.9	21.2	37.7	39.9	37.8	42.9
2	*Maintenance of Laboratory Facilities and Programs*						
	Sub-Total	55.1	55.8	56.8	53.6	61.0	69.6
3	*Maintenance of Stand-by Atmospheric Test Capability*						
	Sub-Total	82.9	72.4	33.7	24.5	22.7	15.6
4	*Monitoring of Sino-Soviet Activity*						
	Sub-Total	96.7	111.9	110.6	106.7	110.2	99.8
	TOTAL	245.6	261.3	238.8	224.7	231.7	227.9

Figure 2

Air Interdiction Operations in North Vietnam

Our air operations against North Vietnam are intended to destroy the enemy transportation system and materiel flow supporting the battles in South Vietnam, and to exact a price for maintaining his forces in the South. Technically, our main problems in this mission are somewhat similar to those I have already discussed: target acquisition, and the accuracy and lethality of our weapons. There are also problems in getting to the target—including penetration of anti-aircraft artillery, surface-to-air missiles and aircraft defenses—and in aircraft survivability once engaged by the defenses. We need better ways to counter conventional anti-aircraft guns. The most promising countermeasures are improvements in achieving greater survivability for our aircraft.

The enemy air defense system as it stands, however, is a formidable threat. The greatest losses in the air war in North Vietnam are our well trained, experienced aircrews. Search and rescue efforts must be improved. I am concerned that our recovery rate of those rescueable aircrewmen have decreased. We have fielded a new rescue vehicle, the HH–53B, which made its first recovery in late November. This aircraft, compared with the HH–3 which it will replace, has more speed and range capability, can hover out of ground effect, and has armor, a better suppressive fire capability, and better navigational aids. Yet this satisfies only a part of the problem of aircrew survivability and search and rescue. We must first assure that an airman can eject from a damaged aircraft and get safely to the ground. Then we must be able to locate and pick him up quickly. We are also studying and experimenting with more advanced rescue concepts such as mid-air snatch of pilots who have ejected. High priority work is also under way on better equipment for locating and communicating with downed aircrewmen.

One alternative to the use of tactical airpower along the coastal region, where many of the significant targets are located, is the use of naval gunfire. The Sea Dragon operation is already underway and will be significantly improved by the addition of a battleship in FY 1969.

Pacification

The pacification of South Vietnam is the goal of our operations in South Vietnam. . . . The DOD contributions to pacification are designed to help isolate the Viet Cong from the populace, to provide security from the Viet Cong/North Vietnam Army main force threat, and to provide the local loyal populace with increasing security from the Viet Cong terrorist and guerrilla forces.

Our research and development programs to meet these goals include work in the Military Departments and in ARPA/AGILE. Studies involve the following: the design of a village and hamlet security system; communications systems improvements to give the lowest echelons of government more reliable means of obtaining assistance when attacked; and design of route security systems to keep Republic of Vietnam lines of communications open. These programs capitalize on the use of appropriate intrustion detection. They also give attention to the improvement of the Regional and Popular Forces largely responsible for local security. . . .

We have established computerized techniques for monitoring guerrilla incidents throughout the country and determining their trends. This provides a way to predict trouble spots—and a format for presenting current and predicted terrorist activity—that can be incorporated in a central local security intelligence system. This will add, at the village and hamlet security level, the capability for reporting, reacting to, and anticipating acts of Viet Cong violence and terrorism. The integrated local and route security efforts represent an important field for DOD research and development and will receive emphasis in FY 1969. Because the necessary technology and many of the needed components already are available, we hope to test a new approach in these activities on a pilot basis in Vietnam during FY 1969.

Another important part of the DOD role in pacification is in the psychological operations of American and Vietnamese forces. Research efforts to develop information necessary for planning sound programs to encourage Viet Cong defection and to increase local support for the government of Vietnam have been started and will continue in FY 1969. . . .

A U.S. Air Force F–100 Supersabre pilot fires folding-fin rockets into an enemy position during a mission over South Vietnam.

Tactical Forces

The purpose of our research and development in tactical warfare is to provide the technical capabilities

needed for U.S. forces to meet a range of possible conflicts, short of a major strategic war, with measured, effective responses. The spectrum of conflict includes guerrilla warfare and counterinsurgency operations (such as in South Vietnam), essentially conventional wars against more sophisticated and mechanized forces (such as we saw in the recent Middle East conflict and in Korea), wars on the seas, and wars involving the possible use of tactical nuclear weapons.

Two basic guidelines apply to this area (as well as to other parts of the R&D program):

- Develop those improved and new capabilities necessary to maintain a technical edge over technologically sophisticated potential enemies.
- Emphasize development of those new systems required to deter—and when necessary, to win—limited wars.

This area of work, while coupled to the special needs emerging from Vietnam, will continue to meet the many broad needs of our general purpose forces, no matter how quickly the war in Vietnam can be terminated.

In the following discussion, I will review our R&D program in the major categories of air, land and sea warfare and airlift.

Air Warfare

. . .With recently acquired Overland Radar Technology (ORT) data, we are ready to proceed with contract definition for Airborne Warning and Controy System (AWACS) in FY 1968 and, assuming continued progress, with development in FY 1969. I am requesting funds in FY 1969 to start development of a system that should satisfy both Air Defense Command (ADC) and the Tactical Air Command (TAC) requirements. AWACS will be used by TAC as a self-contained airborne supplement to the Tactical Air Control System.

We are continuing the development of follow-on versions of Standard ARM in FY 1969 as well as basic technological efforts to counter more sophisticated radars of the mid-1970s.

Interdiction Mission. Intense enemy defenses (anti-aircraft artillery, surface-to-air missiles, and interceptor aircraft) require that we have accurate navigation to the target and about the location of the target under adverse weather conditions and/or at night, as well as increased weapon delivery accuracy. Although these needs are certainly not new, recent technological advances permit the development of significantly improved capabilities. . . .

The introduction of the F–111/MK II into the inventory should provide an improvement in radar bombing accuracy over the F–111A. . . . Funds will be required in FY 1969 to continue the MK II development program.

Similar avionics for the A–7D/E are expected to provide improvement in navigation and weapon delivery accuracy, compared with A–7A. Development of the A–7D/E, which was initiated in FY 1967, will be completed in FY 1969. Test and evaluation will continue into FY 1970.

As the larger aircraft-induced weapon delivery errors are reduced, ordnance characteristics begin to limit weapon delivery capability. Ordnance improvements include the development of reduced-drag stores, the decrease of weapon overheating at supersonic speeds, and a tighter control of ballistic coefficients. Weapon lethality will be increased through development of an improved family of general purpose bombs with greater penetration against hard targets and better fragmentation against area targets. The development of tactical nuclear bombs and standoff missile warheads is being continued to provide further improvement in yield-to-weight ratios.

Guided standoff air-to-ground missiles are another means for precise ordnance delivery. Clearly, the trade-off here is reducing aircraft exposure and attrition in exchange for higher ordnance cost. We are continuing the development of the Condor and Maverick.

Armed Reconnaissance Mission: The principal problems in armed reconnaissance are: finding transitory targets and hitting them. Research and development to improve our capability focuses on the development and application of sensors for night and all-weather detection of targets, and the development of ordnance optimized for use against particular kinds of targets.

Trains, truck convoys, troop concentrations, command centers, surface-to-air missile batteries and storage facilities are typical armed reconnaissance mission targets. These targets are mobile or tranportable, or can be camouflaged effectively when stationary.

Radar technology offers the greatest promise for development of the all-weather capability, and for equipment suited to high-speed strike aircraft (F–4, F–111). The recent advances in microcircuitry, solid state transmitter developments, and steerable array antennas provide the basis for development of new, relatively small, highly reliable and maintainable systems. These systems may offer the improved mapping resolution and moving target indication (MTI) needed for the blind attack of prominent fixed and moving radar targets. We plan further development of critical components, and the extension of digital data processing techniques to attain this capability. In FY 1969, $10 million are programmed for this activity.

Longer-range projects to be initiated in FY 1969 are: a major air-to-ground gun development program with rounds optimized for specific categories of targets, considering the full spectrum of available munitions; and a fuze program to develop improved proximity fuzes, delay fuzes and mine-type fuzes for general purpose bombs.

Close Air Support. Close air support missions are conducted under the direct control of forward air controller (FAC) aircraft and forward ground observers, using target markers, ground based weapon control systems and beacons. The cooperative functioning of controllers and strike aircraft requires communication between Army, Air Force, Navy and Marine units both at the field unit level and at higher levels of command. These communications needs require the development of a short-range squad radio (which does not interfere with the normal activities of the user), and of special lightweight communication equipment for the forward air controller. An airborne near-line-of-sight relay (both manned and unmanned and having greater channel capacity and increased frequency coverage) is being developed to extend the range of battlefield communications. I am requesting funds in FY 1969 for these activities. . . .

The previously discussed A–7D/E—with its substantial loiter time and payload and improved avionics—will provide an excellent close support capability in addition to a long-range interdiction capability. We are also conducting concept formulation studies for a possible new aircraft, the A–X, designed for the close support mission. We are presently examining the relative merits of a simple, inexpensive close support aircraft to augment immediately A–7 and AT–37 forces versus a sophisticated aircraft for A–7 replacement in the mid-1970s. We are providing funds in FY 1969 to continue concept formulation and initiate advanced technology programs. The funding plan contemplates contract definition in FY 1971 for the A–7 replacement system. The Air Force will submit a concept formulation package for the alternate, quick-reaction A–X in FY 1969.

Air Superiority Mission. . . . Tactical aircraft studies conducted in FY 1968 have established the need for improved fighter aircraft (FX/VFAX) in the mid-1970s to perform the escort and air defense missions currently assigned to the F–4 and the F–8. We are requesting funds in FY 1969 to proceed with aircraft designs and preliminary work on the avionics and the engine.

Along with the FX/VFAX airframe development, a need exists for improved air-to-air missiles and high-rate-of-fire guns. Two new advanced development programs were initiated in FY 1968, for which funds are requested.

Land Warfare

Because our tactical doctrine has always emphasized offensive combat operations, I will discuss our land warfare RD in that orientation. But remember that the same equipment is used in defensive or delaying type operations.

Offensive Combat Operations. The essential elements of offensive combat operations are, of course, to find, to fix, and to destroy the enemy.

Battlefield Surveillance and Target Location. Clearly, our first problem is to find the enemy, to locate the targets which we must attack. In my earlier discussion, I mentioned several target location programs for immediate application to Vietnam. In addition to these, we are engaged in advanced development efforts on sensors to extend the reconnaissance capabilities of our ground forces. For FY 1969, support is requested for these broader, longer-range activities.

Ground forces employ reconnaissance scout vehicles in target location operations. Our current vehicle, the M–114, does not provide the desired cross-country speed, mobility and quietness of operation. To overcome the shortcomings of our present equipment, we are conducting concept formulation studies for a new armored reconnaissance scout vehicle. In FY 1969 $3.3 million is requested. We expect to achieve a significant increase in adverse terrain mobility and quietness of operation.

Fixing the Enemy. Once the enemy is located, firepower and mobility are employed to maneuver our forces into a tactically advantageous position. The conventional firepower is provided by artillery weapons.

To provide the required increases in range and mobility for armored warfare, a self-propelled 155mm howitzer is being developed as a general support weapon for the infantry and armored divisions. Contract definition on this weapon, the XM–138, is planned for FY 1969. This weapon will have mobility consistent with MBT–70 equipped forces. We are also considering an armored version of this weapon, the XM–179. The R&D cost for the XM–138 is $3 million in FY 1969.

To meet the longer-range needs of airmobile operations such as those in Southeast Asia, we are performing concept formulation efforts on a rapid fire, lightweight 105mm howitzer system.

An important step toward better field artillery utilization occurred in FY 1968 with the initiation of the TACFIRE program. TACFIRE will apply automatic data processing, storage, and display techniques to the tactical and technical functions of field artillery at all echelons from battalion through corps. TACFIRE should improve the accuracy, timeliness of response, and ability to mass fires. Higher intensity conflicts may demand delivery of ordnance at greater than conventional artillery ranges. Tactical surface-to-surface missiles are being developed for this role.

The Lance was originally designed for targets to a range of 75km carrying either a nuclear or non-nuclear warhead. Development of an Extended Range Version (XRL) was initiated in FY 1967. A recent comparison of Lance and XRL effective-

Troops of the U.S. First Infantry Division take cover from sniper fire during bitter fighting at An My, 42 miles northwest of Saigon.

ness produced the conclusion that only the XRL should be fielded. FY 1969 funding is requested for continued development of the XRL.

The Pershing missile system is presently deployed on a quick-reaction alert in support of NATO. . . . Funds are requested to complete the engineering service tests on the wheeled version of Pershing.

. . . We may enter contract definition of the Mechanized Infantry Combat Vehicle (MICV–70) in FY 1969. This vehicle will provide increased armor protection and have mobility compatible with MBT–70-equipped forces. Four million dollars is requested for this in FY 1969.

The Main Battle Tank (MBT–70) is being developed to provide the heavy armor capability for the mid-1970s. . . . During the past year, we rescheduled this program, and reduced concurrency between development and production. A new goal of production has been established. The cost is consistent with the program plan, and recognizes the financial implications of concurrent U.S. and Federal Republic of Germany efforts. In FY 1969, this program will require $37.9 million.

The development of small, effective anti-tank missiles has provided our forces with a way to combat enemy armor. Because such missiles could be used against our tanks, we are studying appropriate countermeasures. The three anti-tank missiles in our inventory and in development are the Shillelagh, the TOW, and the Dragon. . . . Funds are requested in FY 1969 to complete engineering and service tests. The Dragon is a man-portable, wire-guided missile now in operational systems development. . . . To complete development of this item, $15 million is requested in FY 1969.

. . .To provide the next generation of helicopters for tactical mobility, we plan to carry out concept formulation on the utility tactical transport (UTT) for squad lift, and on the light tactical transport (LTT) for platoon lift. These are planned to replace the UH–ID and the CH–47 helicopters in our current inventory. . . . During FY 1969, $2.3 million is needed for this concept formulation work.

The UTT and LTT will receive enroute protection, reconnaissance support, and suppressive fire support for debarkation/embarkation from the AH–56A, which was committed for production in FY 1968. . . . In FY 1969 $25.4 million is requested for this system.

Final Destruction of the Enemy. To accomplish the final destruction of the enemy, the rifle, pistol, machine gun and grenade come into play. Recognizing the recent small arms developments that have come from industry, we plan to change our procedures to capitalize on this growing industrial capability and interest. Starting in FY 1969, we will restructure our programs and put a substantial portion of exploratory and advanced development funds for small arms on contract.

One of the candidates for a follow-on is a projectile that promises to increase the lethality and hit probability of small arms fire. Its potential advantages—in terms of improved combat effectiveness, reliability, and consequent reduction of personnel casualties—warrant continued vigorous development. For FY 1969, $16.3 million are requested for work on small arms.

Some of our most important, though relatively inexpensive, activities are in the development of personal equipments, lightweight armor, and food items for the soldier.

Special Developments for Defensive and Delaying Operations. By simply changing tactics and methods of employment, the weapons and equipments that I have described are applicable to defensive operations. . . .

For high value targets, we can afford to use our sophisticated defensive systems (Hawk and SAM-D). The Hawk improvement program will enhance that system's capability. For the long term, as a defense against F–111 type aircraft and tactical ballistic missiles, we are continuing the advanced development of the SAM-D system.

The next element of our air defense system, applicable at the division level and higher, is Vulcan/Chaparral. In FY 1969 $9 million are requested to complete this development.

Redeye is an air defense weapon for use by forward echelons in the field Army area. . . . We are continuing to study methods for improvement of the Redeye. Our plan is to initiate an improvement program, as feasible and required, in FY 1970.

Combat Support and Service Support Activities. Our combat support activities, though not always glamorous, are critical and also require R&D effort. . . . In FY 1969 $1.5 million is requested for development of the XM–705.

Communications obviously is an important combat support activity. We are upgrading the security of all tactical circuits for both voice and digital information. Various means of elevating antennas above the foliage (such as balloons and portable towers) are being developed to extend combat communications range. Survival communication for aviation personnel is being provided with improved location devices.

To replace the manual system in the field army area, Project Mallard was initiated in FY 1967 as a joint U.S.-British-Canadian-Australian project. Funds are requested for this project in FY 1969.

A completely mobile radio communications system (RADA) that provides subscriber-to-subscriber communications throughout the division area much like that of a dial telephone, but without wire, is in advanced development and may form the single channel access to the Mallard system. In FY 1969 funds are requested for this program.

During 1968-1969, the three Military Departments—jointly participating in the Tactical Satellite Communications (TACSATCOM) Program—will conduct experiments on the feasibility of using space repeaters for medium- and long-range tactical communications. . . . A limited initial operating capability to respond to certain emergency situations could be available by the end of 1968.

Combat service support activities provide the POL distribution and dispensing equipments, the specialized earth moving equipment, prefabricated airfield surfaces, cargo handling and terminal equipment. All of this permits a high level of close air support. Another group of projects in this area includes the field medical equipment and hospital systems (MUST) that, coupled with helicopter evacuation, have provided our combat soldiers with a greatly increased probability of survival. For these combat support R&D activities, I have requested $15 million in FY 1969.

Sea Warfare

Sea warfare may involve: the projection of U.S. power overseas; the control of vital sea areas; the destruction of enemy naval attack of enemy areas from the sea; and the protection of friendly military and merchant shipping from attack by air, from the surface, or from submarines. . . .

Naval air warfare R&D for the attack carrier striking force was discussed previously. The remaining discussion of R&D for sea warfare will be limited to anti-submarine warfare and the air defense of sea-borne forces, the conduct of amphibious operations, and the development of marine technology and advanced logistics techniques.

Anti-Submarine Warfare. . . . We are starting efforts to reduce the vulnerability of our systems to countermeasures. Anti-submarine (ASW) and anti-air warfare (AAW) systems are being developed to protect our naval forces and shipping from attack by the serious threat of the submarine-launched cruise missile.

Our air ASW capability and the qualitative superiority of our submarines are being improved with development of a new torpedo, the MK 48. We are beginning development of an ocean-wide ASW command and control system; and developing new escorts (DX), as well as improved sensors, weapons, and command and control systems for our escorts. The ASW R&D request totals $384 million.

Airborne ASW. The decision to develop the VSX—a new carrier based ASW aircraft—is a major highlight of our FY 1969 program. . . . I am requesting funds to carry out engineering development of the engine and avionics, and to conduct contract definition. The total R&D cost is expected to be $450 million.

Airborne ASW programs of the last few years have developed an intra-aircraft command and control system (A-NEW) for the landbased ASW aircraft, the P–3; and the DIFAR sonobuoy and signal processing system. Both systems will provide a significant increase in air ASW effectiveness.

To support the P–3C/VSX programs, and to improve sensors and integrated avionics systems for future air ASW systems, the advanced ASW detection program includes a number of projects, for which funds are requested.

Submarine Systems. For the submarine's ASW role, R&D programs emphasize improving sonar, torpedoes, and communications. We have been working on the development of an improved torpedo since 1964, and expanded the program in FY 1967. Because of the importance of this weapon to the submarine force, we are conducting two competitive development activities.

We are also developing sonar improvements for submarines now in the Fleet. These are short-term improvements using available technology and will provide an early increase in capability. In addition, funds are requested for FY 1969 for advanced development of a new submarine sonar system, with the goal of entering contract definition in FY 1970. A request for $1 million is also included for a sonar for the AGSS Dolphin.

Surface Ship ASW Systems. Surface ship ASW systems must be improved to cope with the known steadily increasing capabilities of submarines. We are developing Extended Range ASROC and a command and control system for intra- and intership use to improve coordinated ASW operations.

In contrast to air and land warfare, a large portion of sea warfare expenditures do not fall in the R&D budget because ship construction is largely funded through shipbuilding and conversion (Navy) funds. We are, however, supporting the Navy's urgently needed escort replacement program, DX/DXGN. Because our existing escorts are aging rapidly, and it appears neither prudent nor economical to spend mililons of dollars to modernize them, the Secretary of Defense is requesting five DXs in FY 1969. The recent indications of Soviet naval expansion and movements to far-flung geographic locations strengthens our requirement to maintain a strong escort force.

Anti-Air Warfare. In anti-air warfare, the objective of the R&D effort is to provide improved sensors and weapons to enable the Navy to defend itself successfully against the enemy air threat. . . . A total of $19 million is planned for the basic and advanced point defense systems.

The Advanced Surface Missile System is now entering contract definition. We request funds in FY 1969 to start engineering development.

Communications. In the area of shipboard communications, we are solving several problems. Operations in Southeast Asia and simulated fleet exercises, such as BASELINE, have highlighted the large increase in mes-

The eight-inch guns of the heavy cruiser USS Newport News (CA–148) are fired by crewmembers in a display of naval fire power. Newport News was among the Seventh Fleet ships which participated in Operation Sea Dragon, patrolling the North Vietnam coastline around the clock.

sage traffic, and the needs for more rapid response time in internal command and control, broader inter-force circuit ties for joint operations, and greater circuit flexibility in external communications. To meet these needs, message distribution and circuit control will be automated; monitor and test functions will be provided; and equipment of higher reliability will be developed. These steps also will reduce the likelihood of manual error and reduce the manpower costs for these support functions. The eventual introduction of reliable satellite communication terminals aboard major ships should markedly reduce the transmission problem. As security is added, anti-jam capability must be emphasized on all future vital circuits.

Funds are requested for this advanced communication work in FY 1969. This work was initiated in FY 1968 and will require additional funds by 1972 to complete advanced development.

Amphibious Warfare. This field of warfare encompasses a broad spectrum of sea warfare forces, including small craft, vehicles, ships and weapons. New boat hull designs and propulsion systems are being investigated for landing craft, and a new amphibian, the LVTPX12, has been developed to replace the current amphibian, LVTP5A, which by 1971 will be beyond economical repair. . . . Total R&D cost of the LVTPX12 is estimated at $25.1 million, including $2.4 million in FY 1969 to develop ancillary versions.

The Marines need long-range shore bombardment support before and during amphibious operations. The Landing Force Support Weapon (LFSW) is in concept formulation for this purpose. The Lance missile also has the potential to meet this need and is cheaper; however, it must be tested in a sea environment. Funds are requested to complete feasibility tests and concept formulation of LFSW and this application of Lance.

Concept formultation is also under way on a Landing Fire Support (LFS) ship which will provide major caliber bombardment capability for amphibious assault landings. We plan to complete concept formulation and commence contract definition in FY 1969 leading to LFS ship procurement in FY 1970. FY 1969 funding request is $20 million.

In amphibious shipping, we are developing the LHA, a landing ship that for the first time will transport a complete fighting unit (troops, weapons, vehicles, and helicopters). . . . Contract definition is completed, and engineering development will start with shipbuilding and conversion (Navy) funds in FY 1969.

Other Sea Warfare Programs. Marine Engineering and Technology addresses the development and improvement of shipboard propulsion systems and machinery, hull design and structural improvements, the development of advanced surface craft, ship concept formulation and computerized ship design, submarine safety, damage control and fire prevention, and the Deep Submergence Program. The planned effort provides the capability to correct deficiencies causing serious engineering maintenance and repair problems in the Fleet. It also provides the basis for developing new techniques and concepts for both new construction and future classes of naval vessels.

A program which subjects all major new ship designs to the concept formulation/contract definition procedure has been started. The FDL, LHA, MCS, LFS, and DX/DXG type ships are in the process in FY 1969. Previous year funding of this work was in shipbuilding and conversion (Navy); in FY 1968 the shift of accounting to RDT&E funding began. The Deep Submergence program is a $25 million effort which develops vehicles and technology for personnel rescue from submarines, deep ocean search and salvage, ocean engineering, new diving techniques, and man-in-the-sea capability. We conduct advanced logistics support programs that cover a spectrum from exploratory development of concepts and equipments for facilities, personnel and advance base support, as well as the control, distribution and storage of material, improved systems for aircraft rearming, ship replenishment, Marine Corps logistics, and logistics management. FY 1969 funding request is $12 million.

Airlift

The ability to rapidly transport troops and equipment is an essential element of modern military tactics and strategy. The C–5A aircraft, which is progressing according to plan, will provide the necessary strategic mobility. . . . Funding of $128 million is requested in FY 1969 for the fourth year of full-scale development.

The Air Force has proposed development of a new intra-theater transport aircraft (LIT) to replace the current tactical airlift aircraft

A giant U.S. Air Force C–5A Galaxy, the World's largest aircraft, in the Lockheed-Georgia Co. cantilevered hanger. The new engineering test center, located in Marietta, Ga., was the site of the C–5A rollout on March 2, 1968.

(C–7, C–123 and C–130) in the mid-1970s. . . .

. . .Concept formulation studies are being conducted to define the LIT need. I expect these studies to be completed in late spring, and am requesting funds to preserve the option to initiate contract definition in FY 1969.

V/STOL aircraft, helicopters and hybrid helicopter-aircraft research and development activities are being conducted to provide a firm technological base from which to make a choice in fulfilling future requirements. Survivability in forward areas was recognized as a major problem in FY 1968, leading to concept formulation on less vulnerable systems, the Utility Tactical Transport (UTT) and the Light Tactical Transport (LTT) as replacements for the UH–1D and CH–47. The development of a composite aircraft (CAP) based on the stopped or stowed rotor concept was also considered. CAP development is not being implemented because of the higher priority need for the UTT and LTT.

Research and Technology Base

Introduction—General Assessment

A lesson reinforced over and over throughout history, especially in our era, is that science and engineering continuously make possible completely new military capabilities and threats. National security today—understood broadly and deeply—is more directly linked than ever before to the practice of first rank science and engineering. We have a strong technical-military position today only because we built a strong research and technology base in the past. We must maintain this position. . . .

Research and Exploratory Development Goals. Research and exploratory development are aimed at the future. It may be 10 years or more before a significant result from research is incorporated into an operational system. Similarly, it may be five years or more before a missile structural material proven feasible in exploratory development is used in a significant number of deployed missiles. However, we maintain perspective, and a consistent framework, by adhering to five general, continuing goals which are applicable to both research and exploratory development. I will state and illustrate each of these.

- **To discover and understand scientific phenomena and technological processes relevant to long-term national security.** This leads us to support academic research (and some graduate education), industrial research, and in-house laboratory research necessary to extend the frontiers of defense science and technology. For example, our molecular beam research—conducted primarily in university laboratories 10 years ago—led to "pumping" atomic systems to excited states. This concept led to laser devices.

- **To define the phenomenological and technological limits to weapon capability, both our own and our adversaries.** During the past few years we have been able to reduce the weight of rocket motor cases to the point where they represent only a small percent of the total weight. Materials science might well give further reductions in motor case weight, but we have reached a point of diminishing return. Further reduction in motor weight would not give increased range or payload commensurate with the R&D cost.

- **To preclude technological surprise by others and to provide the basis for disclosed capabilities of our own.** As always in combat, we have disclosed some of our military capability in Vietnam. For example, we have demonstrated our electronic countermeasures against ground-to-air missiles. Thus we must extend our inventory to new effectiveness levels. Furthermore, one must try to go all the way to the frontiers of knowledge and technology to prevent surprise. Going most of the way isn't enough, because the new and surprising may be found beyond that point.

- **To maintain an "on-call" technological ability to deal with problems posed by the innovations of others so that we can respond rapidly and flexibly during crisis.** For example, one of our technological options to the Soviet deployment of ABMs is to put a number of independently targeted warheads in each missile, the so-called MIRV (Multiple Independent Re-entry Vehicles) system. Not all problems have technological solutions, but by providing the greatest number of technological options we enhance the ability of the United States to adopt in minimum time a course consistent with national strategy.

- **To develop new materials, techniques and processes which allow us to increase the maintainability and reliability of operational systems, thus reducing total system cost.**

In managing our technology base, we insist upon two primary characteristics: projects must be responsive and relevant to genuine defense goals, and coupled and integrated wherever feasible with the anticipated needs of advanced and engineering development programs.

* * * *

Research

Before I review the details of our research program, there are two general topics which I should discuss: the unique requirements of DOD in research, the the relationship between defense research and the academic community.

There are many examples of DOD research programs which have led to both a vital defense capability and a valuable innovation in American industry. Perhaps the computer is the best example. However, the facts that the computer has been widely accepted in industry, and that there is now much private financing of computer research and development, do not mean that DOD should not have funded the original developments. Nor do these recent events mean that DOD should not now support critically needed, specific advances in computer capability.

An example of the opposite situation is the field of high energy physics. Formerly we funded a significant amount of research in this area. Today, having gained much relevant knowledge, we are phasing out our support of high energy physics, and we have coordinated with the National Science Foundation to continue the program. We do plan to continue only a few technological projects closely related to defined DOD interests.

It is relatively easy to find one to two hundred innovations due to recent research (or exploratory development) in a major weapon system. Studies have shown that, on the average, about 86 percent were funded directly by DOD and another nine percent by defense industry through profits or independent

R&D. Only five percent came from non-DOD sources. We are convinced that the only efficient route to obtaining the innovations necessary to preserve national security is DOD's direct support of work in areas known to be relevant to DOD.

The general point is that research is indispensable to the DOD mission, though the specific areas of needed research may vary during a period of a few years. All areas are regularly reviewed, with each area judged on its own merits in relation to current priorities.

There is, of course, an attendant responsibility to avoid unnecessary duplication and to seek out cooperative areas with other Federal agencies. Throughout the research activities of the Military Departments and the Advanced Research Projects Agency, there is close liaison—structured by both formal and informal agreements and administrative links—with other R&D components of the Government. For example, the Aeronautics and Astronautics Coordinating Board (AACB) is the vehicle for DOD-NASA coordination. Panels of the AACB coordinate projects in propulsion, launch vehicles, instrumentation, life sciences, materials, support systems in the space environment and others.

Let me turn now to our interactions with the educational process. There is a fundamental relationship between research, the advance of science and technology, and graduate education in science, engineering and medicine. We are apt to think of college education as a process of completing a certain number of courses. This is true for the bachelor degree, but graduate education is quite different. While there is formal course work, the essence of the graduate educational process is the student's research and close collaboration with faculty. Research skills today are developed through the guidance and leadership of a senior scientist who is himself working at the frontier of knowledge.

Thus, when DOD places a contract at a university, we fulfill two of the goals I outlined earlier. First and most important, we reach our principal goal—new scientific knowledge relevant to defense needs. Second, in reaching this goal, we automatically provide the indispensable resources for the research training of graduate students, many of whom will become the staff in laboratories, industry, Federal Contract Research Centers, and academic research groups working on defense problems. The main point is that the two are inseparable: sponsoring research at universities, rather than detracting from the educational process, provides superior graduate education, though graduate education support *per se* is, of course, not a DOD goal. . . .

Research Objectives. I have listed five broad goals which guide our research and technology effort. There are two primary objectives applicable to the research segment:

- To work at the limits of knowledge of natural phenomena, and to extend these limits so that we develop a more complete understanding of the fields of science relevant to national security.
- To determine the physical limits of various fields upon which our weapon systems are designed. These provide the ultimate goals for our systems. In addition, because the Soviet and Chinese regimes are based upon closed societies, we often estimate their best potential capability through a careful scientific analysis of the limits to which any given system might be carried.

* * * *

Future Opportunities. Those in the past who have tried to predict the future of science have usually been far too conservative. For example, one technical forecast in 1937 missed computers, atomic energy, antibiotics, radar and jet propulsion. Yet all of these were incorporated in successful systems within a few years after the forecast. In research, one discovery often interacts with and leads to many others, frequently in fields far from that in which the original advance was made. Therefore, rather than predict, let me briefly review some of our plans for research in areas fertile for future defense needs.

We have ARPA programs in parallel processing and in advanced computer languages. Other research is directed toward better input-output devices and improved man-machine communication. In the field of mathematics, the so-called fast Fourier transform has been developed which should in many cases reduce computational effort by a factor of 1,000 or more, and research in the calculus of variations and in matrix operations should also lead to better, faster computational procedures.

It is, of course, impossible for us to do all of the research needed in any given area. Computers are a good example if only because there has been fantastic progress in the field: it has been estimated that computers have increased in capability at least tenfold every five years. So, one might ask, is it necessary for DOD to perform research in computers and information processing? Why not just wait until the requisite capability emerges from the research done elsewhere? Let me give you three main reasons. First, DOD is the largest user of highly advanced computers in the world. Second, DOD requires unique capabilities such as extreme reliability, great ruggedization, very large systems, and real-time communication between systems. Third, in many areas, the greatest economy and effectiveness of other military developments can only be achieved if certain computer research is pursued as soon as it is recognized by DOD. Thus, we must continue selective programs in this vital area.

Another important field of opportunity is lasers, which offers great promise in the field of communications. Because the frequency of visible light is so much greater than microwave, a laser system can accommodate vastly greater information, and offers increased security in transmission. Accordingly, we plan to devote considerable research to lasers generally.

Through THEMIS we are developing new and relevant research findings while providing special opportunities to universities which have had relatively little past participation in defense-related research. In instituting the program in FY 1967, 173 universities and colleges submitted 483 separate proposals in scientific areas of interest to DOD. Forty-nine THEMIS research centers were selected at 42 institutions representing 31 states. For FY 1968 we have received 413 proposals from 139 institutions, and expect to select approximately 40-50 additional centers.

The FY 1969 request is $36 million to sustain the first 90-100 academic centers, and to start a third group of 40-50 centers. . . .

* * * *

Recommended Budget for Research. I have reviewed in detail the various programs and projects which constitute our research fund request. Accordingly, in FY 1969 I am recommending an increase in our Defense Research (RDT&E) to a total of $450 million. . . .

Exploratory Development

I want to turn now to exploratory development, the other segment of our research and technology base, which is the vehicle for determining the technical feasibility of new findings and inventions. . . .

Specific Exploratory Development Goals. Just as research has its appropriate specific goals, our exploratory development projects are designed to satisfy four primary objectives. I will state each of the objectives, and illustrate each with an effort that has already been completed.

- **Provide higher reliability devices for communication, detection, navigation and guidance.** For example: satellite-assisted battlefield communication and navigation systems, and jungle radio communication systems.

- **Decrease combat vulnerability of both men and equipment, and provide superior resuscitation and support for casualties.** Examples include: improved helicopter and individual armor, and long storage life frozen blood for transfusion.

- **Increase the effectiveness of existing weapons, often thus reducing logistic load and providing our forces with marked superiority.** For example: beehive ammunition, and helicopter fire systems.

- **Reduce operational costs, at constant levels of effectiveness.** There are a host of these including plastic mortar and artillery shipping containers, improved medical care such as through anti-malarial drugs, improved patrol and survival ration kits, and computer applications to logistic, personnel and intelligence operations.

Throughout all of this effort, of course, the underlaying aim is simply a good new idea that can give our forces a qualitative military advantage.

* * * *

Future Opportunities. There isn't enough time to outline our entire future technology program for a complete description would require at least a hundred pages. However, there are many exciting technical opportunities in most areas of military need. Not all of these will be followed up by DOD. Industry is constantly generating new technology, but there are areas where DOD must participate because of unique needs or the lack of sufficient market to rely on speculative development by industry or for other reasons. Again, I will give you a few examples:

In computer technology we will follow-up and consolidate basic advances in both software and hardware. For example, we foresee computer-controlled instructional systems, intelligence analysis, new missile intercept and discrimination calculations to allow more accurate and rapid processing of multiple warhead problems, ruggedized devices for tactical applications, and even lower powered computers for missiles and space vehicles.

In communications, developments are under way on input and output devices utilizing solid state electronics to replace present, more complex, less reliable electromechanical techniques. As an example, we visualize a two-thirds reduction in the volume of teletypewriters. Laser communication techniques, improved methods for underwater communications, and new digital techniques for greatly expanded battlefield communication systems are also in our program.

In materials technology, there are new materials for solid-state electronics, for lasers, and for new superconducting devices. Composites, plastics and ceramics will continue to replace metals for many purposes including armor, aircraft and missile structures, and vehicle parts. For deep submersibles, we expect over the next few years to be able to explore twice the area or carry twice the payload in very deep ocean exploration. The technology to make transparent ceramic armor capable of stopping .50 caliber armor piercing rounds will be extended. Made of crystalline oxides of aluminum and magnesium, these will form windows and windshields for helicopters, light aircraft and armored vehicles.

In conventional ordnance we should realize very small and inexpensive (perhaps one-tenth the cost) proximity fuzes for artillery and air-to-ground attack to small targets such as trucks and tanks.

Intensive effort will continue to go into the problems revealed by the conflict in Southeast Asia. For example, as I have mentioned earlier, we urgently need still better night vision devices, personnel and ambush detectors, detectors for land and river mines, and non-flammable fuel and hydraulic systems for aircraft of all types. . . .

Proposed Budget for Exploratory Development. We have reviewed the programs one by one, tried to relate their cost to our defense needs, and have totaled the funds for necessary activities. As a result, I am recommending funding of $980 million (RDT&E) in exploratory development for FY 1969, essentially the level proposed for FY 1968. . . .

The Advanced Research Projects Agency (ARPA)

I have already mentioned various and exploratory development results in which ARPA has played a major role, particularly in ballistic missiles defense and penetration aids, nuclear test detection, and R&D for Vietnam. We have been restating ARPA's role and emphasizing the management concepts necessary for ARPA to continue to respond promptly to our R&D needs and opportunities. . . .

As you know, ARPA was established in February 1958 in response to a need for centralized management of selected, high-priority projects. ARPA has been an extremely effective way to handle R&D projects that are:

- Multi-Service in nature or at inter-Service boundries, such as counterinsurgency, information processing techniques, and advanced sensor concepts.
- Clearly important to DOD but in areas where Service missions are not yet clear, such as the initial work in advanced ballistic missile defense concepts and nuclear test detection and countermeasures.
- Especially quick-reaction R&D needs, such as for Vietnam.

ARPA's projects are often relatively short-term. They are carried to a certain stage in research or exploratory development, and then transferred to an appropriate Service. . . .

Our FY 1969 budget request for ARPA totals $244.7 million. This includes $53.6 million for research and $191.1 million for exploratory development.

Benefits of Early USATECOM Involvement in Missile Developmental Testing

Lieutenant Colonel Phillip H. Donahue, USA

The U.S. Army Test and Evaluation Command (USATECOM), as part of the Army Materiel Command, conducts independent testing of materiel undergoing development and scheduled for production and issue into the inventory. The normal testing cycle includes first those tests on the materiel, conducted by the contractor and the Army commodity commands, which have as their objective the assurance that the test item meets the design specifications and requirements. This first cycle is the engineer design phase which, when successfully completed, demonstrates the engineering feasibility of incomplete system operations, and that the item is ready for independent engineering testing and service testing by USATECOM.

The engineering test phase verifies that the test item or system, incorporating any corrections made to it as a result of the engineer design testing, meets the required technical characteristics and performance, and determines the technical and maintenance suitability of the item for service testing. The suitability of the item or system and its maintenance package for use by the Army is the prime objective of the service test which is conducted by military personnel. This test is conducted under simulated or actual field conditions to determine if the item or materiel will perform the required mission. This tactical or operational type test provides the basis for recommendations on type classification of the item or system under development.

Development and testing of a complex missile system can be costly and time consuming, and the cycle is further lengthened and becomes more costly when technical difficulties and failures occur during development. All organizations affected are constantly seeking ways by which the time and costs in the development cycle can be reduced and yet field a system that incorporates maximum corrections of deficiencies and shortcomings found during testing. However, the means selected to achieve such goals must not significantly degrade or eliminate required characteristics of the item or system under development.

Certain unique approaches to attain these goals are being applied in the Lance guided missile system and the improvement program for Pershing. The prime engineering test agency of USATECOM, the White Sands Missile Range (WSMR), in the initial stages of program development prepares a comprehensive engineering test program based on the system technical criteria. Coordination with the project manager concerned indicates the testing planned by the contractor or project manager during the engineer design phase. Those test objectives required by WSMR are incorporated in the engineer design test to the maximum extent practicable, and the results will be utilized by WSMR in the final engineering test evaluation. This approach is predicated on the conditions of valid tests results and no significant changes being made to the system prior to engineering test and service test. The result of this coordinated effort should be a minimum engineering test and reduction in test time and cost. In addition, WSMR personnel will monitor or take part in the engineer design testing.

Lt. Col. Phillip H. Donahue, USA, has been assigned to the U. S. Army Artillery Board, Fort Sill, Okla., as chief project officer for the Lance missile system testing since March 1964. Prior to joining the Artillery Board, he served with the Special Ammunition Support Command in Europe. He is a graduate of the U. S. Military Academy.

Early involvement of military personnel from the service test agency is another of the approaches being used to improve development and testing of the Lance, and the improvements to the Pershing. A Lance test team, composed of two officers and 10 senior NCOs from the Army Artillery Board of USATECOM, was formed to assist the project manager and the contractor during the engineer design testing. This team represents a wealth of field experience in field artillery missile and rocket systems, including Corporal, Redstone, LaCrosse, Honest John, Little John, Sergeant and Pershing.

Training for the team on the Lance system was originally provided by the contractor. The primary effort of the team has been to assist the project manager in debugging the equipment and serving as crew members in the system operational testing. These tests are under the direction of the project manager and are conducted on engineering models and tactical prototypes. The developmental effort is culminated in the engineering test and service test of the production configuration by USATECOM.

Some of the tests, which the Artillery Board has conducted or participated in on the Lance engineering model—and most recently on tactical prototype, include field tests, simulated arctic tests, air drop tests,

sighting and laying repeatability/accuracy tests, prelaunch reliability tests, and maintenance evaluation. These have been conducted as simulated tactical exercises where possible and, in all cases, artillery personnel were used as crewmen. Numerous problems were revealed during these tests. Of the deficiencies, shortcomings, or suggested improvements disclosed during the engineering model testing, nearly 25 percent were found solely as a result of troop participation. All were considered during design reviews and, for the most part, resulted in equipment design changes or in operational and maintenance procedural changes. Artillery Board participation does not end with the completion of various tests. Board personnel attend design review meetings and working group sessions to insure that the field (tactical) problems disclosed are clearly understood by design engineers.

Tactical prototype model testing of the Lance is in progress with increased Artillery Board participation. Techniques for processing problem areas disclosed during tests have improved. Contractor awareness and understanding of tactical needs have increased. The suitability of the design of production equipment should consequently be enhanced.

Many of the Lance problems identified would have been found by the contractor had he remained the sole testing agency. However, past experience has demonstrated that many would not have been identified, or at least their significance would not have been realized. The key, then, is the early integration of contractor engineers and USATECOM personnel for testing the system in its early development and under simulated tactical conditions. It is the early integration of USATECOM test agencies that provides the difference. Somewhat similar procedures are being followed for testing of the major improvement program for Pershing with significant results expected.

A preliminary evaluation of the results of early integration of USATECOM test agencies in the engineer design testing of the Lance appears to be very favorable. Unless the basic design is drastically changed, much of the planned engineering testing will be reduced with resultant decrease in cost and testing time. The active participation of service test personnel in engineer design testing has been mutually beneficial to the Lance project manager and USATECOM. The Artillery Board test team, through actual operation of the equipment, had made many significant suggestions for improvements to the system. The team is under the command of the Artillery Board project officer scheduled to conduct the service test of the Lance; thus, the team and its leader will carry the training and experience gained into the engineering test and service test phase. Therefore, much of the service testing may possibly be verification of system capabilities and characteristics.

Such a concept as has been described may be applicable to costly systems of a complex nature; however, it is not suitable for application to all materiel under development, and testing and a complete evaluation of the approach has not been completed. USATECOM will continue its search for more effective, economical, but comprehensive methods of testing Army materiel to achieve reliable testing results.

Assault Helo Office Established in Air Systems Command

The Naval Air Systems Command has established an Assault Helicopter Office which will bring together four helicopter programs (CH–46, CH–53, UH–1 and AH–1) and the Integrated Helicopter Avionics System (IHAS) under a single project manager.

Purpose of the new organization is to strengthen management authority and effectiveness, particularly at the project management level, to enable the Defense Department to acquire, deploy, operate and support assault helicopter systems with the performance capabilities required within the approved schedules and resources.

Named to head the new office is Colonel K. L. Reusser, USMC. Prior to his new assignment, Colonel Reusser commanded a Marine helicopter group in Vietnam.

Commercial Firms Called On for Repair of Army Aircraft

An urgent need for commercially operated plants having the capability for repair and overhaul of Army aircraft and components has been announced by the U.S. Army Aviation Materiel Command (AVCOM) of St. Louis, Mo.

According to AVCOM officials, about 8.5 million manhours of direct labor will be required in aircraft rehabilitation on a commercial basis during the coming fiscal year with a heavier workload predicted for FY 1970.

Fourteen Army aircraft systems, including both rotary and fixed wing, are involved in the expanded commercial overhaul program, including a wide variety of engines, transmissions, rotor blades and other related equipment.

In the past, AVCOM has depended largely upon government-owned and operated repair facilities. With the increased demands due to attrition resulting from the war in Vietnam, greater dependence will be placed upon commerical firms in meeting repair requirements.

Commercial concerns interested in possible contracts for repair and overhaul of Army aircraft and components are urged to contact Leonard Richman, Chief, Industrial Assistance Office, Army Aviation Command, P.O. Box 209, St. Louis, Mo. 63166. Additional information will be forwarded to interested companies identifying items and quantities for which AVCOM will make solicitation on a competitive basis.

Temporary Construction Order Rescinded

The Defense Department has announced the rescinding of the temporary order of Oct. 5, 1967, deferring certain military construction projects not associated with Southeast Asia or otherwise essential.

This action reinstates the remaining FY 1967 and prior year construction projects, as well as FY 1968 construction projects, amounting to a total value of about $800 million.

The Door is Open

Major General John B. Bestic, USAF

Consider the immensity of job placement activities in an organization of nearly one million persons. Mix in over 90 divergent specialties in a world-wide situation. Add the requirement for periodic transfer to effect training and assignment to positions of increasing responsibility. Eliminate personal interviews, except for a relatively few senior management positions. This is the problem, very much over simplified, facing the Deputy Chief of Staff for Personnel of the U.S. Air Force.

Recent developments at the Electronic Systems Division of the Air Force Systems Command, however, have opened the door to computer-assisted personnel assignments. Aptly titled Man-Job Match, this development planning study has paved the way for effective use of manpower.

Not that the system is ready to start reassigning personnel today; a great many factors have yet to be incorporated. But, the method exists, the techniques are feasible, the need is apparent.

The prime obstacle is people. Initial reaction to any suggestion that a computer be used to decide where one should be assigned is something like "over my dead body." In fact, the very basis of the Man-Job Match concept is that the system is a computer-assist for the personnel manager. It is responsive to the manager's needs in handling myriad bookkeeping details involved, offering periodic reports of progress at managerial decision points, and maintaining and updating files. The Man-Job Match system is not designed to replace that vital link, the personnel assignment manager. It is a tool, an assistant—call it what you will. It provides a means whereby this manager can and should, by the very name, be a personnel manager, not a statistics shuffler.

The original Man-Job Match Project, conceived in late 1964, envisioned a small research effort to investigate the feasibility of applying computer technology to the intricate process of personnel assignments. It became immediately apparent, however, that no worthwhile conclusions were possible without some extensive experimentation.

The facilities at the Electronic Systems Division offered the means by which this could be accomplished. A new general purpose data management system, called ADAM (acronym for Advanced Data Management), was implemented on the IBM 7030 (STRETCH) computer. ADAM is a software tool used as a design aid. It provides the necessary framework into which new processes and procedures can be inserted for rapid evaluation and easy modification. ADAM provided the necessary tools to model an assignment system: file generation, on-line file updating, event-triggered reporting, and a query language. This, with the tremendous power of the computer, made modeling changes relatively simple.

Maj. Gen. John B. Bestic, a native of Fargo, N. D., has served as Commander, Electronic Systems Div., Air Force Systems Command, since July 1, 1967. Gen. Bestic is a 1939 graduate of the U. S. Military Academy and has served primarily in communication assignments during his 28 years of military service.

The team selected to do the work consisted of representatives from the offices of the Assistant for Personnel Systems and the Deputy Chief of Staff, Personnel, Air Force headquarters; and the Director of Computers and Technology of the Electronic Systems Division. They started with the results of a research effort conducted from September 1962 to October 1964 by the Personnel Systems Development Office, formerly under the Assistant for Personnel Systems.

This, of course, was not the first effort based on the idea of matching men to jobs. There was major air command interest as early as 1959, and one of the more successful schemes was Project Square Peg. This was a punched card system employed by the Air Force Systems Command for effective resource management of scientific and engineering talent. It has been expanded to include all colonels and all other grades and career fields requiring an advanced degree.

In January 1965, the Assistant Air Force Secretary for Research and Development approved the statement of work and the team effort was officially launched. While the original objective—to identify the necessary techniques and methods leading to the development of a computer-oriented, centralized personnel assignment capability—remained, the requirement for the design and construction of an experimental model became the key to the whole project.

Two models were eventually built from the design specifications. The first (Mod I), crude and inefficient, used a file of 175 men in the United States from the weather officer career field (AFSC 2524) and 200 overseas jobs. The man file used realistic, but hypothetical, data. The job file was constructed to fit the needs of the experiment, since no real job file

existed. Typical entries were based on the Project Square Peg concepts.

Mod I was demonstrated in August 1965 to selected personnel officers. It functioned convincingly in its limited fashion. The foremost result was the decision to expand the scope and comprehensiveness of the project by which means a solid foundation could be established.

The second model (Mod II) encompassed two entire career fields: Weather (25XX) and Personnel (73XX). The officer records, the man file, were the Uniform Officer Records current as of December 1965. The job records, the job file, were actual job descriptions. Each of these files contained about 5,800 records and provided a good test base from which to operate.

Mod II became operational in August 1966 and was demonstrated to personnel assignment officers from throughout the Air Force in late October. These representatives accomplished a review and evaluation of sample assignments, as determined by the Man-Job Match model, in the light of their own experience. They were enthusiastic concerning the flexibility and adaptability of the system. That they had "control" of the system and could both affect and effect assignments, while being relieved of the tedious bookkeeping, was of prime importance to them.

Even before the project was fully documented at the Electronic Systems Division, the next big step had been taken. In mid-March 1967, the Air Force initiated the major command Man-Job Match Project. The purpose was defined to be:

- To design, program and conduct prototype tests of a proposed major command computerized Man-Job Match assignment and career support system for line officers, warrant officer through lieutenant colonel.
- To develop a standard major command Man-Job Match assignment system for processing on standard automatic data processing equipment (the H800/200 system) at the commands. This standard system is to be an effective management tool assisting the major commands in the optimum assignment of available Air Force officers to current and projected vacant positions.

The door has indeed been opened.

DOD Announces Increase in Progress Payment Rates

A change in procurement regulations has been effected by the Defense Department to increase the normal progress payment rates from 70 percent of total incurred costs to 80 percent, under fixed-price contracts having long lead time. For small business concerns, the rate was increased from 75 percent to 85 percent.

The change was made to align financial assistance policies with the greatly increased use of fixed-price contracts by DOD over the past several years. Fixed-price contracts rose from 57.4 percent in contract dollars in 1960 to 78.9 percent in 1967.

The new guidelines are published in Defense Procurement Circular (DPC) No. 58. A more complete description of DOD financial assistance policies is contained in Appendix E of the Armed Services Procurement Regulation. The change contained in DPC No. 58 is as follows:

"E-503 and E-501.1 provide for customary progress payments at the rate of 70 percent of total incurred costs, except that the rate is 75 percent for certain contracts with small business concerns.

"For new contracts (those entered into on or after 1 March 1968), these customary rates will be respectively 80 and 85 percent and such percentages should be substituted in the E-510.1 clause when included in such contracts. For this purpose, new contracts include definitive contracts which supersede letter contracts awarded prior to 1 March 1968.

"This increase of progress payment percentages does not apply to contracts existing before 1 March 1968 or to orders under or modifications of such contracts, whether or not involving additional work or quantities."

Air Defense Command Renamed Aerospace Defense Command

The Air Defense Command, Ent AFB, Colo., was redesignated the Aerospace Defense Command, effective Jan. 15, 1968.

The new designation is intended to better describe the current mission of the command, as increased emphasis continues to be placed on space.

A major component of the North American Air Defense Command, the Aerospace Defense Command has a defense arsenal that includes supersonic fighter-interceptor aircraft, Bomarc ground-to-air missiles, and Genie air-to-air missiles capable of carrying nuclear warheads.

Antisatellite defense of North America, detection and identification of all man-made objects in orbit around the earth, and operation of the ballistic missile early warning system (BMEWS) are only three of the command's vast responsibilities in space surveillance and defense.

Phase III of Joint V/STOL Program Dropped

The U.S. Defense Department and the Federal Ministry of Defense, Federal Republic of Germany have announced that Phase III (prototype acquisition) of the joint U.S.-FRG V/STOL Tactical Fighter Program will not be initiated.

Top military research and development officials of both countries have complimented EWR-Fairchild International on their performance during Phase II of the program. However, due to the lack of a firm operational requirement at this time, a decision has been made against pursuing the program.

EWR-Fairchild is the joint venture organization established by the contractors, Entwicklungsring Sud (EWR) of Germany and the Republic Aviation Division of Fairchild Hiller of the United States.

In accordance with the basic agreement of 1964, the two governments are planning to continue review of V/STOL aircraft requirements and develop a general program to provide for the advances in technology necessary to meet the future V/STOL objectives of the two countries.

SELECTED DEFENSE DEPARTMENT ECONOMIC INDICATORS

(Dollars in Millions; Manpower in Thousands; Quarters by Calendar Year)

	1966 I	II	III	IV	1967 I	II	Jul	Aug	Sep	III	Oct	Nov	Dec	IV
I. *Military Prime Contract Awards*														
Aircraft	$1,945	$2,989	$2,696	$2,262	$2,102	$3,049	$ 394	$ 636	$1,483	$2,513	$1,249	$ 578	$ 805	$2,632
Missile & Space Systems	1,040	987	1,314	861	1,230	1,166	535	521	524	1,580	323	429	316	1,068
Ships	355	491	876	239	679	407	178	104	135	417	153	147	110	410
Weapons & Ammunition	555	1,486	692	940	818	1,769	92	415	597	1,104	454	451	439	1,344
Electronic & Communications Equip.	918	1,574	666	915	971	1,848	169	364	283	816	272	247	305	824
Other Hard Goods	843	1,842	660	1,029	915	1,564	202	355	228	785	252	153	248	653
Soft Goods	709	922	1,078	989	638	652	588	280	188	1,056	175	118	198	491
Construction	207	392	198	150	232	626	56	100	76	232	56	44	113	213
All Other	1,406	1,963	2,356	1,639	1,605	1,987	1,194	568	573	2,335	522	486	649	1,657
Total (Excl. Work Outside U.S.)	7,978	12,646	10,536	9,024	9,190	13,068	3,408	3,343	4,087	10,838	3,456	2,653	3,183	9,292
Total Seasonally Adjusted	8,703	10,144	10,716	10,149	10,171	10,667	3,610	3,686	3,665	10,961	3,665	3,329	3,467	10,461
Work Outside U.S.	521	1,195	856	672	453	834	314	382	195	891	193	117	145	455
II. *Gross Obligations Incurred*														
Operations	8,326	9,604	10,426	9,702	10,229	11,435	3,700	3,835	3,689	11,224	3,776	3,374	----------	----------
Procurement	4,374	8,539	4,368	4,276	5,113	8,948	1,045	1,894	3,215	6,154	2,699	1,717	----------	----------
Other	2,429	3,470	3,453	2,230	2,519	3,510	1,246	1,062	1,112	3,420	860	665	----------	----------
Total	15,129	21,613	19,247	17,208	17,861	23,893	5,991	6,791	8,016	20,798	7,335	5,755	----------	----------
III. *Gross Unpaid Obligations Outstanding*														
Operations	3,828	3,777	4,792	5,024	4,644	4,513	NA	5,115	5,267	5,267	5,270	5,050	----------	----------
Procurement	18,023	22,119	22,736	23,173	22,780	25,248	NA	23,874	24,925	24,925	25,423	24,982	----------	----------
Other	5,747	7,392	8,179	7,888	7,626	8,270	NA	8,559	8,722	8,722	8,598(R)	8,340	----------	----------
Total	27,598	33,288	35,707	36,085	35,050	38,031	NA	37,548	38,914	38,914	39,291(R)	38,372		
IV. *Net Expenditures*														
Operations	7,689	9,076	8,968	9,087	10,002	10,731	2,898	3,722	3,382	10,001	3,641	3,456	3,397	10,494
Procurement	3,651	3,886	4,392	4,264	5,074	5,282	2,037	1,982	2,041	6,060	2,005	1,890	1,704	5,599
Other	2,757	2,647	2,484	3,092	3,179	2,001	1,231	883	933	3,047	790(R)	847	723	2,360
Total	14,097	15,609	15,844	16,443	18,255	18,014	6,166	6,587	6,356	19,108	6,436(R)	6,194	5,824	18,453
V. *DOD Personal Compensation*														
Military	3,181	3,249	3,551	3,606	3,624	3,646	1,310	1,260	1,272	3,842	1,264	1,297		
Civilian	1,937	2,015	2,105	2,135	2,170	2,248	736	793	742	2,271	773	772	776(p)	2,321(p)
Total	5,118	5,264	5,656	5,741	5,794	5,894	2,046	2,053	2,014	6,113	2,037	2,069		
VI. *Outstanding Payments*														
Advance Payments	66	79	90	83	92	80	--------	--------	--------	110	--------	--------	----------	----------
Progress Payments	4,402	4,346	4,750	5,461	5,981	6,765	--------	--------	--------	7,179	--------	--------	----------	----------
Total	4,468	4,425	4,840	5,544	6,073	6,845	--------	--------	--------	7,289	--------	--------	----------	----------
VII. *Strength (Manpower)*														
Military	2,969	3,094	3,229	3,334	3,371	3,377	3,382	3,393	3,412	3,412	3,416	3,412		
Civilian	1,088	1,138	1,184	1,230	1,268	1,303	1,311	1,306	1,274	1,274	1,277	1,277	1,271(p)	1,271(p)

NA = Not Available
P = Preliminary
R = Revised
Note: Open spaces for Indicators other than No. VI indicate information not available at time of publication.
Indicator No. VI information available only on a quarterly basis. Totals may not add due to rounding.

Directorate for Statistical Services
OASD (Comptroller)
29 January 1968

SELECTED DEFENSE DEPARTMENT ECONOMIC INDICATORS

(Dollars in Millions; Manpower in Thousands; Quarters by Calendar Year)

	1966 I	II	III	IV	1967 I	II	Jul	Aug	Sep	III	Oct	Nov	Dec	IV	1968 Jan
I. *Military Prime Contract Awards*															
Aircraft	$1,945	$2,989	$2,696	$2,262	$2,102	$3,049	$ 394	$ 636	$1,483	$2,513	$1,249	$ 578	$ 805	$ 2,632	$ 442
Missile & Space Systems	1,040	987	1,314	861	1,230	1,166	535	521	524	1,580	323	429	316	1,068	348
Ships	355	491	876	239	679	407	178	104	135	417	153	147	110	410	109
Weapons & Ammunition	555	1,486	692	940	818	1,769	92	415	597	1,104	454	451	439	1,344	226
Electronic & Communications Equip.	918	1,574	666	915	971	1,848	169	364	283	816	272	247	305	824	359
Other Hard Goods	843	1,842	660	1,029	915	1,564	202	355	228	785	252	153	248	653	246
Soft Goods	709	922	1,078	989	638	652	588	280	188	1,056	175	118	198	491	437
Construction	207	392	198	150	232	626	56	100	76	232	56	44	113	213	61
All Other	1,406	1,963	2,356	1,639	1,605	1,987	1,194	568	573	2,335	522	486	649	1,657	457
Total (Excl. Work Outside U.S.)	7,978	12,646	10,536	9,024	9,190	13,068	3,408	3,343	4,087	10,838	3,456	2,653	3,183	9,292	2,685
Total Seasonally Adjusted	8,703	10,144	10,716	10,149	10,171	10,667	3,610	3,686	3,665	10,961	3,665	3,329	3,467	10,461	2,862
Work Outside U.S.	521	1,195	856	672	453	834	314	382	195	891	193	117	145	455	288
II. *Gross Obligations Incurred*															
Operations	8,326	9,604	10,426	9,702	10,229	11,435	3,700	3,835	3,689	11,224	3,776	3,374	3,663	10,812	----------
Procurement	4,374	8,539	4,368	5,276	5,113	8,948	1,045	1,894	3,215	6,154	2,699	1,717	1,876	6,292	----------
Other	2,429	3,470	3,453	2,230	2,519	3,510	1,246	1,062	1,112	3,420	860	665	669	2,194	----------
Total	15,129	21,613	19,247	17,208	17,861	23,893	5,991	6,791	8,016	20,798	7,335	5,755	6,208	19,298	----------
III. *Gross Unpaid Obligations Outstanding*															
Operations	3,828	3,777	4,792	5,024	4,644	4,513	NA	5,115	5,267	5,267	5,270	5,050	5,150	5,150	----------
Procurement	18,023	22,119	22,736	23,173	22,780	25,248	NA	23,874	24,925	24,925	25,423	24,982	24,856	24,856	----------
Other	5,747	7,392	8,179	7,888	7,626	8,270	NA	8,559	8,722	8,722	8,598	8,340	8,082	8,082	----------
Total	27,598	33,288	35,707	36,085	35,050	38,031	NA	37,548	38,914	38,914	39,291	38,372	38,088	38,088	----------
IV. *Net Expenditures*															
Operations	7,689	9,076	8,968	9,087	10,002	10,731	2,898	3,722	3,382	10,001	3,641	3,456	3,397	10,494	----------
Procurement	3,651	3,886	4,392	4,264	5,074	5,282	2,037	1,982	2,041	6,060	2,005	1,890	1,704	5,598(R)	----------
Other	2,757	2,647	2,484	3,092	3,160	2,001	1,231	883	933	3,047	790	847	724(R)	2,363(R)	----------
Total	14,097	15,609	15,844	16,443	18,236	18,014	6,166	6,587	6,356	19,108	6,436	6,194	5,825(R)	18,455(R)	----------
V. *DOD Personal Compensation*															
Military	3,181	3,249	3,551	3,606	3,624	3,646	1,310	1,260	1,272	3,842	1,264	1,297	----------	----------	----------
Civilian	1,937	2,015	2,105	2,135	2,170	2,248	736	793	742	2,271	773	772	787	2,332	830(P)
Total	5,118	5,264	5,656	5,741	5,794	5,894	2,046	2,053	2,014	6,113	2,037	2,069	----------	----------	----------
VI. *Outstanding Payments*															
Advance Payments	66	79	90	83	92	80	--------	--------	--------	110	--------	--------	----------	134	----------
Progress Payments	4,402	4,346	4,750	5,461	5,981	6,765	--------	--------	--------	7,179	--------	--------	----------	7,491	----------
Total	4,468	4,425	4,840	5,544	6,073	6,845	--------	--------	--------	7,289	--------	--------	----------	7,625	----------
VII. *Strength (Manpower)*															
Military	2,969	3,094	3,229	3,334	3,371	3,377	3,382	3,393	3,412	3,412	3,416	3,412	3,398	3,398	----------
Civilian	1,088	1,138	1,184	1,230	1,268	1,303	1,311	1,306	1,274	1,274	1,277	1,277	1,271	1,271	1,267(P)

NA = Not Available
P = Preliminary
R = Revised

Note: Open spaces for Indicators other than No. VI indicate information not available at time of publication. Indicator No. VI information available only on a quarterly basis. Totals may not add due to rounding.

Directorate for Statistical Sevicesr
OASD (Comptroller)
29 February 1968

DEFENSE PROCUREMENT

Contracts of $1,000,000 and over awarded during the month of February 1968.

DEFENSE SUPPLY AGENCY

2—**J. P. Stevens & Co.,** New York, N.Y. $1,257,125. 445,000 linear yards of tropical wool cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1346.

—**Southwire Co.,** Carrollton, Ga. $1,799,000. 50,000 half-mile field telephone wire dispensers. Defense Industrial Supply Center, Philadelphia, Pa. DSA 500–68–C–8044.

7—**Trenton Textile Engineering Co.,** Trenton, N.J. $1,645,347. 240,900 wet weather parkas. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1463.

—**J. P. Stevens & Co.,** New York, N.Y. $1,153,500. 300,000 linear yards of wool serge cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1524.

9—**Kentucky Appalachian Industries,** Prestonburg, Ky. $1,970,811. 10,498 medium general purpose tents with cover and window. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1181.

14—**West Point-Pepperell, Inc.,** New York, N.Y. $1,636,975. 2,224,000,000 square yards of cotton duck cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1558.

16—**LaCrosse Garment Mfg. Co.,** La Crosse, Wis. $1,850,681. 119,739 sleeping bags. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1608.

19—**Sparling Mills,** Greenville, R.I. $2,739,100. 15,000,000 polypropylene sandbags. Defense General Supply Center, Richmond, Va. DSA 400–68–C–4471.

—**Dowling Bag Co.,** Valdosta, Ga. $1,150,725. 6,000,000 polypropylene sandbags. Defense General Supply Center, Richmond, Va. DSA 400–68–C–4468.

—**Pioneer Bag Co.,** North Kansas City, Mo. $1,406,340. 7,400,000 polypropylene sandbags. Defense General Supply Center, Richmond, Va. DSA 400–68–C–4469.

—**Bemis Co.,** Minneapolis, Minn. $1,319,875. 7,025,000 polypropylene sandbags. Defense General Supply Center, Richmond, Va. DSA 400–68–C–4470.

—**Burlington Industries,** New York, N.Y. $1,476,000. 1,500,000 linear yards of windresistant cotton poplin cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1621.

—**B. G. Colton & Co.,** New York, N.Y. $1,322,375. 1,250,000 linear yards of windresistant cotton poplin cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1623.

—**Dan River Mills, Inc.,** Danville, Va. $1,721,250. 1,700,000 linear yards of windresistant cotton poplin cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1622.

—**Bibb Mfg. Co.,** Macon, Ga. $3,353,630. 697,882 linear yards of high-temperature resistant polyamide cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1595.

—**Putnam Mills,** New York, N.Y. $2,395,000. 500,000 linear yards of high temperature resistant polyamide cloth. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1594.

CONTRACT LEGEND

Contract information is listed in the following sequence: Date—Company — Value — Material or Work to be Performed—Location of Work Performed (if other than company plant) — Contracting agency.

—**Campbell Soup Co.,** Camden, N.J. $1,029,492. 297,640 cases of ready-to-serve soup. Defense Personnel Support Center, Philadelphia, Pa. DSA 130–8–C–02058.

23—**Genesco, Inc.,** Florence, Ala. $1,697,142. 693,880 pairs of men's winter lightweight drawers. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1635.

—**Carborundum Co.,** Niagara Falls, N.Y. $1,495,808. 2,050 sets of body armor. Defense Personnel Support Center, Philadelphia, Pa. DSA 100–68–C–1580.

28—**Pettibone Mulliken Corp.,** Washington, D.C. $1,872,254. 197 electric forklift trucks with 4,000-lb. capacity, and 96 electric forklift trucks with 6,000-lb. capacity. Defense General Supply Center, Richmond, Va. DSA 400–68–C–4656.

29—**Southern Packaging & Storage Co.,** Greenville, Tenn. $1,209,384. 1,782,000 cases of individual combat meals. Defense Personnel Support Center, Philadelphia, Pa. DSA 130–8–C–092A1.

DEPARTMENT OF THE ARMY

1—**Kennedy Van Saun Corp.,** Danville, Pa. $1,947,020. Metal parts for 105mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA–AA09–68–C–0109.

—**Bethlehem Steel,** Bethlehem, Pa. $4,000,000. Tube forgings for 175mm guns (M113). Army Arsenal, Watervliet, N.Y. DA–AF07–68–C–0153.

—**Mohawk Rubber Co.,** Akron, Ohio. $1,650,602. Pneumatic tires. Tank Automotive Command, Warren, Mich. DA–AE07–68–C–1355.

—**General Motors,** Indianapolis, Ind. $2,634,948. Rebuilding/retrofiting of transmissions for M48 and M103 tanks. Tank Automotive Command, Warren, Mich. DA–20–113–AMC–12016 (T).

2—**Texas Instruments,** Dallas, Tex. $1,700,000. Night Vision Aerial Surveillance Systems. Mobility Equipment Research & Development Center, Fort Belvoir, Va. DA–AK02–68–C–0308.

—**Kisco Co.,** St. Louis, Mo. $1,008,537. Shipping containers for 20mm projectiles. Frankford Arsenal, Philadelphia, Pa. DA–AA25–68–C–0421.

—**International Harvestor Co.,** Chicago, Ill. $1,106,332. Tractor trucks and dump trucks. Springfield, Ohio., Fort Wayne, Ind., and Chatnam, Ontario, Canada. Tank Automotive Command, Warren, Mich. DA–AE–68–C–1318.

—**Hercules Engines, Inc.,** Canton, Ohio. $34,192,681. Multi-fuel engines for 2½-ton trucks and one lot of concurrent repair parts. General Purpose Vehicle Project Manager, Warren, Mich. DA–AE06–68–C–0006.

—**Kaiser Jeep Corp.,** Toledo, Ohio. $117,898,298. 2½-ton trucks. South Bend, Ind., Ruf, Neb. and Lima, Ohio. General Purpose Vehicle Project Manager, Warren, Mich. DA–AE06–68–C–0007.

5—**Magnavox Co.,** Urbana, Ill. $5,917,685. Artillery gun direction computers. Frankford Arsenal, Philadelphia, Pa. DA–AA25–68–C–0429.

—**General Motors,** Detroit, Mich. $2,145,069. Various trucks. Tank Automotive Command, Warren, Mich. DA–AE07–68–C–1322.

—**State of Illinois,** Department of Public Works and Buildings, Springfield, Ill. $1,793,000. Removal and replacement of Illinois State Highway No. 154 bridge with a substitute fixed-span high-level bridge to allow passage of navigation. Baldwin, Ill. Engineer Dist., St. Louis, Mo. DA–CW43–68–C–0013.

—**Baldwin Electronics,** Little Rock, Ark. $1,609,601. Loading, assembling and packing 2.75-inch rocket motors. Camden, Ark. Picatinny Arsenal, Dover, N.J. DA–AA21–67–C–0756.

—**AVCO Corp.,** Stratford, Conn. $1,218,258. Production facilities for spare parts for UH-1 helicopter engines. Aviation Material Command, St. Louis, Mo. DA–23–204–AMC–04152 (T).

6—**United Aircraft,** East Hartford, Conn. $3,075,000. CH-54A aircraft engines. Aviation Materiel Command, St. Louis, Mo. DA–AJ01–67–C–0875.

—**Northland Camps, Inc.,** Nampa, Idaho. $2,095,843. Procurement of trailer type houses including furniture and air conditioning to be used for housing technical personnel engaged in the Nike-X research and development program at Kwajalein Atoll, Marshall Islands. Engineer Dist., Honolulu, Hawaii. DA–CA83–68–C–0012.

7—**American Machine & Foundry Co.,** Brooklyn, N.Y. $9,921,576. Metal parts for 750-lb. bombs. Garden City, N.Y. Ammunition Procurement & Supply Agency, Joliet, Ill. DA–AA09–68–C–0161.

—**Lear Siegler, Inc.,** Anaheim, Calif. $4,309,831. Metal parts for 105mm cartridge fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA–AA09–67–C–0295.

—**Chrisberg, Inc.,** Seattle, Wash. $2,269,275. Construction of 20 miles of gravel surface road; erection of a 200-man trailer type construction camp; construction of camp utility systems and erection of miscellaneous camp buildings at Amchitka Island, Alaska. Engineer Dist., Anchorage, Alaska. DA–CA85–68–C–0053.

8—**C. H. Leavell & Co.,** Houston, Tex. $15,085,615. Construction of a basic military training facility at Lackland AFB, Tex. Engineer Dist., Fort Worth, Tex. DA–CA63–68–C–0060.

—**Chamberlain Mfg. Corp.,** New Bedford, Mass. $4,910,415. Metal parts for 155mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA–AA09–68–C–0321.

—**General Electric,** Burlington, Vt. $4,085,718. 20mm automatic guns. Procurement Agency, New York, N.Y. DA–AF03–67–C–0033.

—**Northrop Corp.,** Anaheim, Calif. $2,128,289. 105mm projectiles. Picatinny Arsenal, Dover, N.J. DA–AA21–68–C–0517.

—**Chamberlain Mfg. Corp.,** New Bedford, Mass. $1,987,776. Metal parts for 155mm projectiles. Ammunition Procurement & Supply Agency, Joliet, Ill. DA–AA09–68–C–0325.

9—**Rulon Co.,** Chicago, Ill. $4,353,501. Metal parts for 105mm cartridge fuzes. Ammunition Procurement & Supply Agency, Joliet, Ill. DA–AA09–67–C–0296.

—**R. G. LeTourneau, Inc.,** Longview, Tex. $3,219,827. 750-lb. bomb fin assemblies. Ammunition Procurement & Supply Agency, Joliet, Ill. DA–AA09–68–C–0329.

—**John Wood Co.,** St. Paul, Minn. $3,006,848. 750-lb. bomb fin assemblies. Ammunition Proceurement & Supply Agency, Joliet, Ill. DA–AA09–68–C–0328.

—**Guy H. James Construction Co.,** Oklahoma City, Okla. $3,167,296. Alteration of the Will Rogers Turnpike Twin Bridges over the Verdigris River to permit passage of project navigation. Catoosa, Okla. Engineer Dist., Tulsa, Okla. DA–CW56–68–C–0090.

—**P. R. Mallory and Co., Inc.,** Tarrytown, N.Y. $2,385,694. Dry batteries. Lexington, N.C. Electronics Command, Philadelphia, Pa. DA–AB05–67–D–2982.

—**Honeywell, Inc.,** St. Petersburg, Fla. $1,000,000. Classified electronics equipment. Electronics Command, Fort Monmouth, N.J.

12—**Bechtel Corp.,** Vernon, Calif. $1,692,016. Architect engineer services for design of Sentinel anti-ballistic missile system radar power plant. Office of Chief of Engineers, Washington, D.C. DA–CA–73–68–C–0006.

—**General Dynamics**, Rochester, N.Y. $4,151,538. AN/GRC-106 radio sets. Electronics Command, Philadelphia, Pa. DA-AB05-68-C-0003.

—**Honeywell, Inc.**, Hopkins, Minn. $3,919,965. Point detonating fuzes for 40mm cartridges. New Brighton, Minn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0114.

—**Olin Mathieson Chemical Corp.**, LaPorte, Ind. $4,156,852. Loading, assembling and packing of 20mm incendiary cartridges. Frankford Arsenal, Philadelphia, Pa. DA-AA25-68-C-0430.

13—**Fordice Construction Co.**, Delta, La. $1,681,160. Revetment materials for the Mississippi River and Tributaries Flood Control Project. Engineer Dist., New Orleans, La. DA-CW-29-68-C-0127.

—**T. L. James & Co., Inc.**, Ruston, La. $1,233,352. Navigational channel dredging. Morrilton, Ark. Engineer Dist., Little Rock, Ark. DA-CW03-68-C-0040.

—**Matson Terminals, Inc.**, San Francisco, Calif. $14,825,000. Stevedoring and related services for period of March 1, 1968 through Feb. 28, 1970. Military Traffic Management & Terminal Services, Oakland, Calif. DA-HC-23-68-D-0076.

—**California Stevedore & Ballast Co.**, San Francisco, Calif. $24,608,000. Stevedoring and related services for period March 1, 1968, through Feb. 28, 1970. Military Traffic Management & Terminal Services, Oakland, Calif. DA-HC23-68-D-0075.

—**Marine Terminal Corp. of Los Angeles**, Long Beach, Calif. $18,811,000. Stevedoring and related services for period of March 1, 1968, through Feb. 28, 1970. Military Traffic Management & Terminal Services, Oakland, Calif. DA-HC23-68-C-0071.

—**Chamberlain Mfg. Corp.**, Waterloo, Iowa. $1,325,964. High explosive projectiles. Picatinny Arsenal, Dover, N.J. DA-AA21-68-C-0691.

14—**Beech Aircraft Corp.**, Wichita, Kan. $3,258,000. Modification of U-21A aircraft. Aviation Materiel Command, St. Louis, Mo. DA-AJ01-67-C-0794.

—**Raytheon Co.**, Lexington, Mass. $3,070,200. Metal parts for 750-lb. bombs. Bristol, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0027.

—**Continental Motors**, Mobile, Ala. $2,794,500. Rebuild and retrofit of M88 recovery vehicle engines. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-1166.

15—**Harvey Aluminum Sales**, Torrance, Calif. $15,366,031. Loading, assembling and packing miscellaneous items of medium caliber ammunition and components, and for maintenance and support services at the Ammunition Plant, Milan, Tenn. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00520 (A).

—**UNeCo, Inc.**, Bellevue, Neb. $3,536,938. Metal parts for 105mm cartridge fuze components. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-67-C-0306.

—**Keystone Mfg. Corp.**, Boston, Mass. $1,788,860. Metal parts for 105mm cartridge fuze components. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-67-C-0356.

—**Chamberlain Mfg. Corp.**, Elmhurst, Ill. $1,404,928. Modernization and support activities in support of production of metal parts for 175mm, M437 projectiles. Scranton, Pa. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-36-034-AMC-00163 (A).

—**Raytheon Co.**, Andover, Mass. $9,124,215. Line items of Hawk missile system ground support equipment. Army Missile Command, Huntsville, Ala. DA-AH01-68-C-0073.

—**Raytheon Co.**, Lexington, Mass. $1,593,322. Industrial engineering services for the self-propelled Hawk Missile System. Army Missile Command, Huntsville, Ala. DA-01-021-AMC-12547 (Z).

16—**Philco-Ford**, Newport Beach, Calif. $1,573,517. FY 1968 research and development on the Chaparral missile system. Anaheim, Calif. Army Missile Command, Huntsville, Ala. DA-AH01-68-C-0725.

—**E. I. Dupont DeNemours Co.**, Wilmington, Del. $1,072,401. Establishment of lead azide manufacturing facilities at the Kansas Army Ammunition Plant, Parsons, Kan. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-67-C-0213.

—**National Gypsum Co.**, Buffalo, N.Y. $17,961,860. Loading, assembling and packing of 105mm and 81mm projectiles and fuzes. Parsons, Kan. Ammunition Procurement & Suppy Agency, Joliet, Ill. DA-11-173-AMC-000095 (A).

—**Raytheon Co.**, Andover, Mass. $3,373,049. Factory test equipment and gauging for the improved Hawk missile system. Army Missile Command, Andover, Mass. DA-AH01-67-C-A028.

—**General Motors**, Detroit, Mich. $2,582,133. 924 delivery trucks. Flint, Mich. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-1424.

—**AVCO Corp.**, Stratford, Conn. $18,059,660. T-53-L-13 engines for various helicopters. Aviation Materiel Command, St. Louis, Mo. DA-AJ01-68-C-0954.

—**Philco-Ford Corp.**, Philadelphia, Pa. $1,000,000. Classified electronic equipment. Electronics Command, Fort Monmouth, N.J.

—**Martin Zachry Constructor**, Honolulu, Hawaii. $2,100,000. Construction work on site preparation for 200 trailers at Kwajalein Atoll. Engineer Dist., Honolulu, Hawaii. DA-94-612-ENG-04111.

19—**Hercules, Inc.**, Wilmington, Del. $12,088,267. Propellants and explosive materials, and support services at the Army Ammunition Plant, Radford, Va. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-W-11-173-AMC-00037 (A).

—**Whittaker Corp.**, Saugus, Calif. $1,681,090. MK 125 igniters for 2.75-inch rocket motors. Picatinny Arsenal, Dover, N.J. DA-AA21-68-C-0674.

20—**Philco-Ford Corp.**, Newport Beach, Calif. $1,399,650. Test sets for the Shillelagh guided missile system. Army Missile Command, Huntsville, Ala. DA-AH01-67-C-1146.

—**General Motors**, Detroit, Mich. $1,398,788. Diesel engines for the M113 family of vehicles. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-0410.

21—**Brunswick Defense Corp.**, Muskegon, Mich. $1,911,441. Half-ton platform utility trucks. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-1572.

—**Peter Kiewit & Sons Construction Co.**, Vancouver, Wash. $1,424,062. Construction of recreation facilities. Gilliam County, Sherman County and Umatilla County, Ore. Engineer Dist., Walla Walla, Wash. DA-CW68-68-C-0064.

—**General Research Corp.**, Santa Barbara, Calif. $1,291,925. ARPA system research studies. Army Missile Command, Huntsville, Ala. DA-AH01-67-C-1334.

—**TRW, Inc.**, Redondo Beach, Calif. $1,000,000. Classified electronic equipment. Electronics Command, Fort Monmouth, N.J.

23—**Philco-Ford**, Philadelphia, Pa. $2,531,000. Maintenance and operation service for Integrated Wide Band Communication Sites in Southeast Asia. Electronics Command, Fort Monmouth, N.J. DA-28-043-AMC-01694 (E).

—**Amron Corp.**, Waukesha, Wis. $1,178,489. Classified ammunition components. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0046.

—**Wyatt-Kipper Engineers**, Seattle, Wash. $1,079,655. Conversion of heating plant boilers from coal to natural gas and for a 10,000 barrel oil storage tank. Elmendorf AFB, Alaska. Engineer Dist., Anchorage, Alaska. DA-CA85-68-C-0054.

—**AVCO Corp.**, Richmond, Ind. $1,010,038. Classified ammunition components. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0045.

26—**General Motors**, Detroit, Mich. $1,187,798. V53 diesel engines for M113 vehicles. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-0410.

—**General Motors**, Indianapolis, Ind. $1,113,000. Breech mechanism assemblies for 152mm gun/launchers. Army Arsenal, Watervliet, N.Y. DA-AF07-67-C-0065.

—**Marathon Battery Co.**, Wausau, Wis. $2,180,200. Dry batteries. Electronics Command, Philadelphia, Pa. DA-AB05-68-C-2253.

—**Clevite Corp.**, Freeport, Ill. $2,310,000. Dry batteries. Electronics Command, Philadelphia, Pa. DA-AB05-68-C-2254.

—**Motorola, Inc.**, Chicago, Ill. $2,719,890. Metal parts for boosters for artillery fuzes. Elk Grove Village, Ill. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0340.

27—**Technical Operations, Inc.**, Burlington, Mass. $3,241,600. 1,480 man-months of scientific and technical effort in support of studies, analyses, and evaluation of war games. Arlingtin, Va. Army Procurement Agency, Oakland, Calif. DA-AG05-67-C-0547.

—**Whirlpool Corp.**, Evansville, Ind. $1,301,427. 106mm anti-personnel projectiles. Picatinny Arsenal, Dover, N.J. DA-AA21-68-C-0468.

—**United Aircraft**, Stratford, Conn. $1,896,600. Blade assemblies for CH-54A helicopters. Aviation Materiel Command, St. Louis, Mo. DA-23-204-AMC-03369 (T).

28—**William McWilliams Industries**, New Orleans, La. $1,321,054. Dredging work on the Atchafalaya Basin Flood Control Project. St. Martin's and St. Mary's Parish, La. Engineer Dist., New Orleans, La. DA-CW29-68-C-0131.

—**C. F. Bean, Inc.**, Plaquemine, La. $1,248,980. Construction work on the Atchafalaya Basin Flood Control Project. Iberville Parrish, La. Engineer Dist., New Orleans, La. DA-CW29-68-C-0132.

—**Ingraham Co.**, Bristol, Conn. $1,870,000. Booster metal parts. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0213.

—**Hercules, Inc.**, Wilmington, Del. $1,582,164. Electric blasting caps. Port Ewen, N.Y. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0334.

—**General Motors**, Indianapolis, Ind. $3,697,620. Transmission assemblies for M48 and M60 tanks. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-0436.

—**E. G. and G., Inc.**, Albuquerque, N.M. $1,054,400. Equipment and services in connection with underground nuclear testing at the Nevada Test Site. Defense Atomic Support Agency. DASA01-68-C-0079.

—**Mack Trucks, Inc.**, Allentown, Pa. $2,025,235. 32 dump trucks, 43 tractor trucks and spare parts for both vehicles. Tank-Automotive Command, Warren, Mich. DA-AE-07-68-C-1637.

29—**Firestone Tire & Rubber Co.**, Akron, Ohio. $1,185,776. Maintenance and support services at Ravenna Army Ammunition Plant, Ravenna, Ohio. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00065 (A).

—**Olin Mathieson Chemical Corp.**, New York, N.Y. $35,720,958. Operation of plant for production of propelling charges and related items. Indiana Army Ammunition Plant, Charleston, Ind. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-11-173-AMC-00097 (A).

—**Raytheon Co.**, Norwood, Mass. $10,132,723. Telephone converters and multiplexers. North Dighton, Mass. Electronics Command, Philadelphia, Pa. DA-36-039-AMC-04878 (E).

—**Kasler Corp.**, Riverside, Calif. $8,054,776. Construction of an earth fill dam in connection with the Mojave River Reservoir Preject. Victorville, Calif. Engineer Dist., Los Angeles, Calif. DA-CW09-68-C-0028.

—**McMenamy Contractor, Inc.**, St. Charles, Mo. $2,724,340. Dredging and appurtenant work for navigation channel within Dardanelle Reservoir Reach of the Arkansas River Navigation Project. Engineer Dist., Little Rock, Ark. DA-CW03-68-C-0048.

—**General Motors**, Indianapolis, Ind. $1,057,387. Turbo shaft engines for the light observation helicopter. Aviation Materiel Command, St. Louis, Mo. DA-AJ01-68-C-1333.

—**Stevens Mfg. Co.**, Edensburg, Pa. $1,241,040. Six-ton semi-trailers. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-1614.

—**General Motors**, Indianapolis, Ind. $2,183,540. Transmission units or related sections for M107/M109/M110 and M578 tracked combat vehicles. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-0836.

—**Chicago Aerial Industries**, Barrington, Ill. $1,366,940. 46 KKA-76 cameras, lens cones and lens carrying cases. Electronics Command, Philadelphia, Pa. DA-AB05-67-C-3302.

—**AFC Industries**, St. Louis, Mo. $1,459,573. Body assemblies for fuzes for various size cartridges. Olivette, Mo. Army Procurement Agency, Chicago, Ill. DA-AA09-68-C-0267.

—**Harvard Industries, Inc.**, Farmingdale, N.J. 602 AN-GRC-50 radio sets. Electronics Command, Philadelphia, Pa. DA-AB05-68-C-0016.

—**A. O. Smith Corp.**, Chicago, Ill. $11,984,315. Metal parts for 750-lb. bombs. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-68-C-0078.

—**Electro-Optical, Inc.**, Pomona, Calif. $1,361,388. Night vision sights. Electronics

Command, Philadelphia, Pa. DA-AB07-68-C-0262.

—**University of Illinois**, Urbana, Ill. $1,200,000. Electronics research. Electronics Command, Fort Monmouth, N.J. DA-AB07-67-C-0199.

—**Mack Trucks, Inc.**, Allentown, Pa. $1,090,800. Five-ton truck diesel engines. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-1625.

—**Dana Corp.**, Toledo, Ohio. $1,184,927. Transmission assemblies for 2½ and 5-ton trucks. Tank Automotive Command, Warren, Mich. DA-AE07-68-C-1631.

—**Grumman Aircraft Engineering Corp.**, Bethpage, N.Y. $1,969,113. OV1 Mohawk aircraft and related items. Aviation Materiel Command, St. Louis, Mo. DA-AJ01-67-C-0795.

—**General Motors**, Cleveland, Ohio. $7,319,520. 81mm projectile M374 bodies and band assemblies. Ammunition Procurement & Supply Agency, Joliet, Ill. DA-AA09-67-C-0195.

—**Mack Trucks, Inc.**, Allentown, Pa. $4,000,000. Ten-ton tractors. Tank-Automotive Command, Warren, Mich. DA-AE07-68-C-0872.

DEPARTMENT OF THE NAVY

1—**Honeywell, Inc.**, West Covina, Calif. $4,373,590. Anti-submarine warfare training devices, including data and support. Naval Training Device Center, Orlando, Fla. N61339-68-C-0086.

—**Lockheed Aircraft**, Burbank, Calif. $2,110,060. Classified work on Navy aircraft. Naval Air Systems Command. N00019-67-C-0697.

—**Westinghouse Electric**, Baltimore, Md. $1,675,089. AN/APG-59 radar sets. Naval Air Systems Command. N00019-67-C-0173.

—**Lockheed Missiles & Space Co.**, Sunnyvale, Calif. $1,677,500. Polaris modification kits. Special Projects Office. N00030-67-C-0222.

2—**Bell Helicopter Co.**, Fort Worth, Tex. $4,688,795. Light training helicopters. Naval Air Systems Command. N00019-68-C-0363.

—**United Boatbuilders**, Bellingham, Wash. $1,500,000. Sixth-six 31-foot river patrol boats. Naval Ship Systems Command. N00024-68-C-0285.

5—**American Mfg. Co. of Tex.**, Fort Worth, Tex. $9,887,140. Mark 83, Mod 3 bomb bodies. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68-C-3481.

—**University of California, Marine Physical Laboratory**, San Diego, Calif. $2,396,982. Marine physics research. Office of Naval Research.

—**Metal Engineering Corp.**, Greenville, Tenn. $1,752,120. Mark 83, Mod. 3 bomb fin assemblies. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68-C-3482.

6—**LTV Aerospace Corp.**, Dallas, Tex. $13,468,000. A-7B aircraft. N00019-67-C-0082. $6,700,000. A-7D aircraft. Naval Air Systems Command. N00019-67-C-0143.

—**Honeywell, Inc.**, Minneapolis, Minn. $8,619,125. Rockeye II components. Hopkins, Minn. Naval Air Systems Command. N00019-68-C-0315.

—**Sperry Rand Corp.**, St. Paul, Minn. $5,500,000. Avionics computers. Naval Air Systems Command. N00019-68-C-0255.

—**Stromberg-Carlson Corp.**, San Diego, Calif. $3,000,000. Tactical display systems. Naval Air Systems Command. N00019-68-C-0253.

—**United Aircraft**, Stratford, Conn. $1,500,000. Long lead time effort and materials in support of planned procurement of HH-3F helicopters. Naval Air Systems Command. N00019-67-C-0141.

—**General Dynamics**, Pomona, Calif. $3,580,000. Increase of limitation of authorization of production for the Standard missile (medium range). Naval Ordnance Systems Command. N00017-67-C-0047.

7—**Peterson Builders**, Sturgeon Bay, Wis. $2,376,780. Construction of 100-foot patrol motor gunboards. Naval Ship Systems Command. N00024-68-C-0309.

—**General Dynamics**, Daingerfield, Tex. $1,706,135. Operating and maintenance service to perform research and development testing at the Ordnance Aerophysics Laboratory. Naval Ordnance Systems Command. N00017-68-C-2402.

8—**United Aircraft**, East Hartford, Conn. $24,357,821. TF30-P-8 engines. Naval Air Systems Command. N00019-68-C-0155.

—**Hughes Aircraft**, Culver City, Calif. $2,400,000. Incremental funding for Phoenix missile systems. Naval Air Systems Command. NOw 63-0379.

—**Mine Safety Appliances**, Pittsburgh, Pa. $1,522,674. Oxygen breathing appartuses and canisters for fire-fighting and damage control. Evans City, Pa. Navy Ships Parts Control Center, Mechanicsburg, Pa. N000104-68-C-3950.

9—**Canadian Department of Defense Production**, Washington, D.C. $1,025,908. Bathythermograph transmitter sets. Dartmouth, Nova Scotia, Canada. Naval Air Systems Command. N00019-68-C-0371.

—**Woods-Hole Oceanographic Institution**, Woods-Hole, Mass. $1,062,619. Surveys of ocean characteristics pertaining to acoustic transmission and analysis of surveys. Office of Naval Research.

—**G. L. Cory, Inc.**, San Diego, Calif. $1,048,135. Construction of an aircraft maintenance hanger at the Naval Air Station, North Island, San Diego, Calif. Southwest Div., Naval Facilities Engineering Command, San Diego, Calif. N62473-67-C-3014.

12—**Honeywell, Inc.**, North Hopkins, Minn. $32,483,044. MK 46 torpedo main assemblies and related equipment. Naval Ordnance Systems Command. N00017-68-C-1306.

—**Goodyear Aerospace Corp.**, Akron, Ohio. $5,600,000. Subroc missiles. Naval Ordnance Systems Command. N00017-68-C-1408.

—**General Electric**, Syracuse, N.Y. $1,070,000. Operation and maintenance of sonar test equipment. Naval Ship Systems Command. N00024-68-C-1114.

13—**Thiokol Chemical Corp.**, Elkton, Md. $3,165,239. Design and development of a rocket motor for the hyper-velocity aircraft rocket, tactical (HART), air-to-surface missile. Naval Ordnance Laboratory, White Oaks, Md. N60921-68-C-0168.

14—**Bethlehem Steel**, Bethlehem, Pa. $15,324,456. Steel forgings for MK 14, MOD 0, 16-inch projectiles. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68-C-3524.

—**United Aircraft**, Stratford, Conn. $11,500,000. Long lead time effort and materials in support of procurement of CH-53A helicopters. Naval Air Systems Command. N0w 63-0150.

—**Blaw-Knox Co.**, Pittsburgh, Pa. $10,348,275. Machining of steel forgings into MK 14, MOD 0, 16-inch projectiles. Groveton, Pa. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00104-68-C-3525.

16—**Automation Industries**, Ann Arbor, Mich. $1,625,119. Seven degaussing range systems, associated repair parts and services. Naval Ship Systems Command. N00024-68-C-5251.

19—**Lockheed Aircraft Corp.**, Burbank, Calif. $1,183,004. Universal Julie Jezebel Maintenance and Operator Trainers with data and support. Naval Training Device Center, Orlando, Fla. N-61339-68-C-0131.

20—**Lockheed Aircraft**, Burbank, Calif. $9,748,200. Modifications to SP-2H aircraft. Naval Air Systems Command. N00019-67-C-0237.

—**Lockheed Aircraft**, Burbank, Calif. $3,200,000. Configuration changes to P-3B aircraft. Naval Air Systems Command. N00019-68-C-0043.

—**General Time Corp.**, Skokie, Ill. $1,471,320. Mechanical time fuzes. Naval Air Systems Command. N00019-68-C-0314.

—**Johns Hopkins University Applied Physics Laboratory**, Silver Spring, Md. $34,043,350. Research and development for Bumblebee. Naval Ordnance Systems Command. N0w 62-0604c MOD 60.

—**Intercontinental Mfg. Co.**, Garland, Tex. $11,216,768. 500-lb. bomb bodies. Navy Ships Parts Control Center, Mechanicsburg, Pa. N00-104-68-C-3526.

—**Goodyear Aerospace Corp.**, Akron, Ohio. $2,880,469. Updating of an A-6A weapon system trainer component with data and support items. Naval Training Device Center, Orlando, Fla.

—**General Motors**, Goleta, Calif. $1,000,000. Design, development, test proof and qualifications of a warhead and exploder for MK 48 MOD 0 torpedoes. Naval Ordnance Systems Command. N000-67-1218 Mod 4.

21—**Kincaid Co.**, Honolulu, Hawaii. $2,239,296. Installation of a power plant and system improvements at the Naval Oceanographic Research Facility, and improvements to the Albatross Abatement System at the Midway Island Naval Station. Pacific Div., Naval Facilities Engineering Command, Pearl Harbor, Hawaii. NBy-79995.

—**George Washington University**, Washington, D.C. $1,400,000. Logistics planning research. Office of Naval Research.

—**Newport News Shipbuilding & Drydock Co.**, Newport News, Va. $1,000,000. Advance planning design and the procurement of long lead time materials in preparation for the overhaul and alteration of the nuclear powered ballistic missile submarine USS Daniel Webster (SSBN-626). Naval Ship Systems Command. N00024-68-C-0208.

23—**Kaman Aircraft**, Bloomfield, Conn. $2,768,320. Conversion of UH-2A/B helicopters to UH-2C configuration, plus progressive aircraft rework. Naval Air Systems Command. N00019-67-C-0084.

—**Royal Industries**, Santa Ana, Calif. $2,571,717. External auxiliary 600-gallon fuel tanks. Alhambra, Calif. Naval Air Systems Command. N00019-68-C-0090.

—**General Dynamics**, Pomona, Calif. $2,754,715. Engineering services and supplies for Terrier/Tartar and Standard missiles. Naval Ordnance Systems Command. N00017-68-C-2110 G8-0622-025.

—**Bendix Corp.**, Missile Systems Div., Mishawaka, Ind. $1,000,000. Engineering effort for conversion of Talos Missile Telemetry Systems from VHF to UHF and from FM/FM to PAM/FM. Naval Ordnance Systems Command. N00017-68-C-4301c G8-0622-046.

26—**United Aircraft**, East Hartford, Conn. $66,946,000. TF30-P-12 and TF30-P-3 engines. Naval Air Systems Command. N00019-67-C-0332.

—**F. D. Rich Co.**, Stamford, Conn. $3,373,368. Construction of 200 family housing units at the Newport, R.I., naval base. Northeast Div., Naval Facilities Engineering Command, Boston, Mass. Nby-71189.

27—**Denarde Construction Co.**, San Francisco, Calif. $1,780,000. Construction of 100 family housing units at Hunters Point Naval Ship Yard, San Francisco, Calif. Western Div., Naval Facilities Engineering Command, San Bruno, Calif. Nby-85507.

28—**Computer Applications, Inc.**, New York, N.Y. $4,048,153. Reliability engineering services in connection with weapon systems under development by the Naval Weapons Center, China Lake, Calif. Ridgecrest, Calif. Navy Purchasing Office, Los Angeles, Calif. N00-123-68-C-2062.

—**McDonnell Douglas Corp.**, Long Beach, Calif. $1,430,900. Increased limitation of authorization of A-4F aircraft. Naval Air Systems Command. N00019-67-C-0170.

—**General Dynamics**, Groton, Conn. $1,000,000. Advanced planning design and procurement of materials in preparation for the overhaul and alteration of the nuclear powered submarine USS Dace (SSN-607). Naval Ship Systems Command. N00024-68-C-0273.

29—**Ball Bros. Research Corp.**, Boulder, Colo. $1,300,000. Development of an Apollo Telescope Mount. Office of Naval Research.

—**Continental Electronics Mfg. Co.**, Dallas, Tex. $2,510,918. Radio transmitters. Naval Electronic Systems Command. N00039-68-C-1539.

DEPARTMENT OF THE AIR FORCE

2—**Itek Corp.**, Palo Alto, Calif. $6,507,490. Production of airborne radar components for various aircraft. Warner-Robins Air Materiel Area, (AFLC), Robins AFB, Ga. AF 04606-67A-1818.

—**Martin-Marietta Corp.**, Orlando, Fla. $2,159,862. Production of radio transmitter components. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68C-0080-P002.

5—**International Telephone & Telepgraph Corp.,** Nutley, N.J. $13,569,862. Production of airborne LORAN navigational sets and related equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-67-C-0524.

6—**General Electric,** Utica, N.Y. $5,200,000. Airborne electronics countermeasure equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF F33657-68-C-0664.

7—**Battelle Memorial Institute,** Columbus, Ohio. $1,060,000. Operation of the Defense Metals Information Center for FY 1968. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF F33615-68-C-1325.

8—**B. F. Goodrich Co.,** Akron, Ohio. $1,-137,901. Production of aircraft tires. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF F42600-68-C-2481-AFIN 1416.

—**Goodyear Tire & Rubber Co.,** Akron, Ohio. $1,837,547. Production of aircraft tires. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF F42600-68-D-1367-AFIN 1433.

—**Lockheed Aircraft,** Burbank, Calif. $9,-233,000. TF 104G aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF F333657-67-C-1383.

—**Curtiss-Wright Corp.,** Wood-Ridge, N.J. $1,826,370. Production of aircraft cylinder assemblies. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. AF F41608-67-A-5900.

—**Marwais Steel Co.,** Richmond, Calif. $1,-553,400. Manufacture of metal bin-type vertical revetments. 2750 Air Base Wing, Wright-Patterson AFB, Ohio. AF F33601-68-C-0581.

—**Bunker-Ramo Corp.,** Canoga Park, Calif. $1,170,633. Production of display consoles. Rome Air Development Center, Griffiss AFB, N.Y. AF 30602-68-C-0221.

9—**International Telephone & Telegraph Corp.,** Nutley, N.J. $4,335,578. Production of airborne LORAN navigational sets and related equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF F33657-67-C-0524.

—**Hazeltine Corp.,** Little Neck, N.Y. $1,-468,000. Production of command and control electronics equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF F33657-68-C-0539.

13—**Bendix Corp.,** North Hollywood, Calif. $1,226,213. Production of airborne electronics equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F 33657-68-C-0563.

14—**Sargent Fletcher Co.,** El Monte, Calif. $1,588,420. Production of fuel tank assemblies for F-4 aircraft. Oklahoma Air Materiel Area, (AFLC), Hill AFB, Okla. F04606-68-A-0108-QP04.

—**Lockheed Missile & Space Co.,** Sunnyvale, Calif. $4,508,383. Agena launch services at Vandenberg AFB, Calif., for period Oct. 1, 1967-Sept. 30, 1968. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. F04701-68-C-0070-P-006.

—**Cullman Metalcraft, Inc.,** Cullman, Ala. $2,649,360. Production of bomb components. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0810.

—**L.T. Industries,** Dallas, Tex. $2,916,000. Bomb components. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0201.

—**Radiation, Inc.,** Melbourne, Fla. $2,693,-753. Design and installation of a telemetry and communication station in the United Kingdom. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. F04701-68-C-0201.

—**American Electric, Inc.,** La Mirada, Calif. $2,649,360. Production of bomb components. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-68-C-0809.

—**Superior Steel Ball Co.,** New Britain, Conn. $2,925,000. Bomb components. Washington, Ind. Aeronautical Systems Div., (AFSC), Wright-Patterson, AFB Ohio. F33657-68-C-0688.

—**Philco-Ford Corp.,** Palo Alto, Calif. $4,-985,657. Manufacture and installation of a telemetry antenna system. Air Force Eastern Test Range, Patrick AFB, Fla. F 08606-68-C-0031.

15—**General Electric,** Philadelphia, Pa. $2,-600,000. Reentry vehicle flight testing. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. AF 04 (694)-914.

—**Radiation, Inc.,** Melbourne, Fla. $1,500,-000. Development and production of an air/ground communication system. Palm Bay, Fla. Electronic Systems Div., (AFSC), L. G. Hanscom Field, Mass.

16—**LTV Electrosystems, Inc.,** Greenville, Tex. $1,988,300. Modification of C-130 aircraft. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F-33657-68-C-0707-P004.

—**Cessna Aircraft,** Wichita, Kan. $10,394,-945. A-37B aircraft spare parts and aerospace ground equipment. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F33657-C-0824-P-25.

—**Air Products & Chemical, Inc.,** Allentown, Pa. $1,225,323. Propellant oxygen and nitrogen. Santa Susana, Calif. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. AF 36-600-24258.

19—**Litton Systems.** Woodland Hills, Calif. $4,375,444. Navigational instrument replenishment spares for F-111A aircraft. Duluth, Minn. Sacramento Air Materiel Area, (AFLC), McClellan AFB, Calif. F 4606-67-A-0472-0031.

—**North American Rockwell Corp.,** Anaheim, Calif. $4,549,775. Production of the missile guidance and control systems for Minuteman II missiles. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. F 42600-68-2614.

—**Continental Aviation & Engineering Corp.,** Detroit, Mich. $6,701,592. Production of J-69 engines. Toledo, Ohio. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio.

—**University of Michigan,** Ann Arbor, Mich. $1,777,695. Research into measurement of the electro-magnetic characteristics related to weapon delivery applications. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. F 33615-68-C-1281.

20—**International Business Machines Corp.,** Cape Kennedy, Fla. $1,501,363. Rental of automatic data processing equipment. Patrick AFB, Fla. Air Force Eastern Test Range, Patrick AFB, Fla. AF 08650-68-M-M391.

21—**Big Three Industrial Gas & Equipment Co.,** Houston, Tex. $1,156,845. Production of propellant nitrogen to support Project Apollo. Titusville, Fla. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. AF 41608-68-D-1519.

23—**Chromally American Corp.,** New York, N.Y. $1,257,780. Repair and application of protective metallic coating on J-57 turbine nozzle guide vanes. West Nyack, N.Y. San Antonio Air Materiel Area, (AFLC), Kelly AFB, Tex. AF 1608-67-D-7444.

26—**Fairchild Hiller Corp.,** Germantown, Md. $20,801,258. Repair and modification of C-119 aircraft. St. Augustine, Fla. Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. AF 09603-68-C-1633.

—**R&D Constructors, Inc.,** Park Ridge, Ill. $1,931,720. Aircraft maintenance workstands for C-141 aircraft. Batavia, Ill. Warner Robins Air Materiel Area, (AFLC), Warner Robins Air Materiel Area, (AFLC), Robins AFB, Ga. AF 09603-68-C-1401.

—**Olin Mathieson Chemical Corp.,** East Alton, Ill. $1,702,748. Bomb components. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF 42600-68-C-2182.

—**General Electric,** West Lynn, Mass. $4,-900,000. Component improvement program for the J-85 aircraft engine. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68-C-512.

28—**Aerojet General Corp.,** Sacramento; Calif. $1,288,000. Work on rocket motors. Ogden Air Materiel Area, (AFLC), Hill AFB, Utah. AF 04606-68-A-0068-QP04.

—**North Electric Co.,** Galion, Ohio. $5,899,-505. Production of central office telephone equipment. Electronic Systems Div., (AFSC), L. G. Hanscom Field, Mass. AF 19628-67-C-0270.

—**LTV, Inc.,** Dallas, Tex. $1,100,000. Development work on space vehicles. Space & Missile Systems Organization, (AFSC), Los Angeles, Calif. AF04(695)-1050.

—**Sperry Rand Corp.,** Salt Lake City, Utah. $3,000,000. Development and fabrication of a data relay system. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68-C-0910.

29—**General Electric,** Cincinnati, Ohio. $2,-000,000. Engineering effort and services for support of the J79 engine during calendar year 1968. Evandale, Ohio. Aeronautical Systems Div., (AFSC), Wright-Patterson AFB, Ohio. AF 33657-68-C-0527.

New President Named to Defense Science Board

Dr. Robert L. Sproull, Vice President for Academic Affairs at Cornell University, has succeeded Dr. Frederick Seitz, President of the National Academy of Sciences, as chairman of the Defense Science Board.

The board has also received a new vice chairman with Thomas L. Phillips, President of the Raytheon Co., succeeding Patrick E. Haggerty, Chairman of the Board of Directors of Texas Instruments, Inc.

New members-at-large are Dr. John L. McLucas, President of the Mitre Corp.; Dr. Ithiel de Sola Pool, Chairman of the Department of Political Science at Massachusetts Institute of Technology; and Dr. Albert D. Wheelon, Vice President of Hughes Aircraft Co.

The Defense Science Board is chartered as the senior technical advisory body in the Defense Department. It consists of members-at-large appointed from civilian life and of ex-officio members representing major Federal agencies.

Purpose of the board is to advise the Secretary of Defense, through the Director of Defense Research and Engineering, on scientific and technical matters of interest to the Defense Department.

Dr. Seitz and Mr. Haggerty will continue as members of the board.

Subscribers Note

Due to the rapidly increasing number of subscribers to the *Defense Industry Bulletin*, it has become necessary to have our subscription list computerized. As is often the case in such a changeover, we expect problems with addresses for the first few months. If you do not receive your May issue by the 10th of the month, send us a card or letter asking to be put back on the mailing list. If your address is incorrect in any way, send us both the address as it appeared and the correct address.

The Editors

CLARK M. CLIFFORD BECOMES NINTH SECRETARY of DEFENSE

Chief Justice Earl Warren administers the oath of office to Secretary of Defense-designate Clark M. Clifford as Mrs. Clifford and President Lyndon B. Johnson look on. The ceremony took place at the White House March 1.

☆ U. S. GOVERNMENT PRINTING OFFICE : 1968 300-977/9